THE

JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

VOL. XXII. No. 542.] LONDON, JULY 1, 1873. [25TH YEAR.] Price 1s.

RAMSAY'S NEWCASTLE CANNEL COAL. Analysis—10,000 cubic feet of gas per ton of coal: 26-candle gas: 13½ cwt. coke per ton of coal.
The London Exhibition in 1851 was lighted with gas made from Ramsay's Cannel.
RAMSAY'S PATENT CONDENSED COKE.
DO. GARESFIELD COKE.

RAMSAY'S FIRE-CLAY ARTICLES.
GAS-RETORTS, introduced 1823. FIRE-BRICK WORKS, established 1804. FIRE-CLAY SANITARY PIPES, CHIMNEY-TOPS, and all Goods made of Fire-Clay. The Fire-Clay is worked from Blaydon Main Colliery, is of excellent quality, and no expense spared in perfecting every article. The FIRE-BRICKS (marked "RAMSAY") are to be seen in all parts of the world, and the Works are the most extensive in the Kingdom.
Manufactories—Derwenthaugh, Swalwell, and Hebburn Quay, near Newcastle-on-Tyne; and London Wharves—Falcon Wharf, No. 30, Bankside; and Honduras Wharf, Cubitt Town. Large stocks kept.
Address G. H. RAMSAY, NEWCASTLE-ON-TYNE.

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Patentees of the Standard Gasometers for the Government, and of the
IMPROVED DRY GAS-METERS.

These Meters are warranted to measure correctly and not to vary. Their acknowledged superiority has brought them into general use more rapidly than any Meters hitherto manufactured.
To meet the increasing demand, G. GLOVER AND CO. have just entered on possession of extensive premises adjoining their present Works in Ranelagh Road, and they are now prepared to execute promptly, orders to any extent. They keep in stock all sizes of Meters up to 200 lights. In cases of haste, on the receipt of a telegram early on one day, their Meters can be delivered next day in any part of England, and in the large towns in Scotland.
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236, GEORGE STREET, GLASGOW;
OR
15, MARKET STREET, MANCHESTER.

COWEN'S PATENT FIRE-CLAY RETORTS.
JOSEPH COWEN and CO.,
BLAYDON BURN, NEAR NEWCASTLE-ON-TYNE,
Were the only parties to whom a PRIZE MEDAL was awarded at the GREAT EXHIBITION of 1851, for "GAS-RETORTS and OTHER OBJECTS in FIRE-CLAY," and they have also been awarded in the INTERNATIONAL EXHIBITION of 1862, the PRIZE MEDAL for "GAS-RETORTS, FIRE-BRICKS, &c., for EXCELLENCE of QUALITY."
J. C. and Co. have been for many years the most extensive Manufacturers of Fire-Clay Retorts in the United Kingdom; and orders for Fire-Clay Retorts of all shapes and dimensions, Fire-Bricks, and every other article in Fire-Clay, are promptly executed at their Works as above.
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Coal Office,
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THE ALMA WORKS, WALSALL.
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FOR GAS, STEAM, & WATER, EITHER BLACK, GALVANIZED, OR ENAMELLED.

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For Locomotive, Marine, and Stationary Boilers.

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THE UNVARYING WATER-LINE GAS-METERS,

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AND GAS APPARATUS OF EVERY DESCRIPTION.

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By use of which Man-lid, inlet and outlet pipes can be examined and cleansed without loss of gas in crown of holder, or ingress of atmospheric air.

ROOFS, GIRDERS, BRIDGES, AND BOILERS OF ALL KINDS.

Drawings, Specifications, and Estimates supplied on application.

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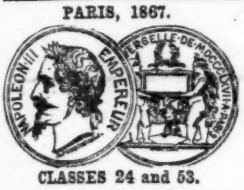
PARIS, 1867.



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LONDON, 1862.

CLASSES 13 and 31.

PUBLIC LAMP GOVERNORS, LEVER COCKS, AND POLE LIGHTERS

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1862.

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MADE ONLY BY

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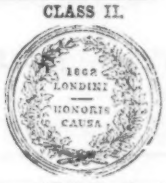

This Paint having been in general use over eleven years (especially in some of the principal Gas-Works), and proved itself the best light-coloured Paint produced for resisting the influence of vitiated atmospheres, it is important that its qualities should be more widely known.

It is not discoloured like white lead in a sulphuretted atmosphere, nor washed off like white zinc; and its light colour reflecting heat, produces much less expansion of gas in holders painted with it than with dark colours, besides rendering them much more sightly. Its specific gravity is so much below white lead that the same weight will cover one-third more surface, while it is equal in body; and its price being about the same (30s. per cwt.), it is actually one-third cheaper. From experience, its manufacture is greatly improved, and it is quite suitable for all purposes in which white lead is employed.

Reference is kindly permitted by the Engineers of the City of London, Commercial, London, and Surrey Consumers Gas Companies, who pronounce it the best Paint known for their purposes.

N.B.—Antimony Paint, COVERING SO MUCH MORE WORK, costs about 20s. per cwt., as compared with White Lead at 30s. per cwt.; a similar economy arises from its use in Steam and Gas Joints, for which purpose it is superior to White Lead.

TO ENGINEERS, GAS COMPANIES, RAILWAY COMPANIES, &c.

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CALLEY'S GENUINE "TORBAY" PAINT

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THESE PAINTS ARE SPECIALLY PREPARED, and are most valuable for protecting and arresting rust on all ironwork, AND WILL COVER TAR EFFECTUALLY; they adhere strongly, acquire great solidity, do not crack, flake off, or blister by heat, and they resist the effects of SULPHUROUS AND GASEOUS EXHALATIONS.

They are used extensively at a large number of GAS-WORKS, on Gasholders, Purifiers, and all classes of Ironwork; also by Government, Railway Companies, &c.

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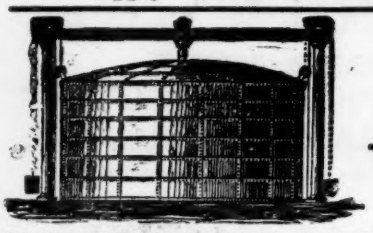
FIRE-CLAY GAS-RETORTS & FIRE-BRICKS,

Of every size and shape, and of the best quality; also of White and Coloured GLAZED BRICKS, SANITARY PIPES, &c., &c.

The F. I. Co. have the exclusive right to make and sell Fraser's Patent "Ribbed" Gas-Retorts in Fire-Clay.

In order to meet the constantly increasing demand for their Gas-Retorts, the F. I. Co. have recently made such an addition to their premises as will enable them to execute expeditiously the largest home or foreign orders.

Apply as above, or to the London Offices, 15, NEW BROAD STREET, E.C.



IMPROVED GAS APPARATUS,

FOR CITIES, TOWNS, VILLAGES, &c.,

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WHITESTONE IRON-WORKS, HUDDERSFIELD.

SOLE MANUFACTURERS of B. W. THURSTON'S IMPROVED SCRUBBER, CONDENSER, and WASHER, in use in many of the principal Gas-Works on the Continent.

PATENTEES of the IMPROVED COMBINED PURIFYING APPARATUS, so eminently adapted for Exportation.

ESTIMATES, PLANS, and SPECIFICATIONS PREPARED for BUILDINGS and APPARATUS.

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REFERENCES TO UPWARDS OF 300 GAS-WORKS.

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And all kinds of GAS APPARATUS.

Wrought-Iron Roofs, Bridges, and Girders; Steam, Hot Water, and Range Boilers; Tanks, Cisterns, &c.,

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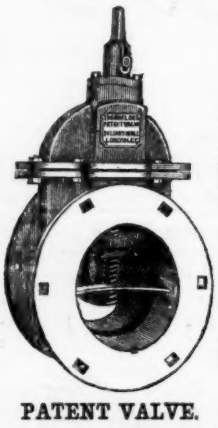

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SOLE MAKERS OF

CHANDLER AND SON'S

PATENT REGULATING DIP-PIPE.

Copy Testimonial.—A series of experiments have taken place at the Erith Gas-Works with "Chandler's Patent Dip-Pipe," which was found to prevent any deposit of carbon taking place at the back or on the surface of the clay retorts; there was also considerable increase of gas per ton of coal carbonized, whilst the apparatus continues working with the greatest simplicity and certainty.

Prospectus, with Price Lists and Particulars, on Application.

THORNELOE'S PATENT VALVE

For GAS and WATER, from 3 to 24 inches,

SUPPLIED FROM STOCK.

They are now in use at the following Gas-Works in London:—PHŒNIX and SOUTH METROPOLITAN; also at Aylesbury, Aldershot, Colchester, Farnham, Guildford, Leicester, Ilford, Middlesboro' Patent Gas Company, Reading, &c.

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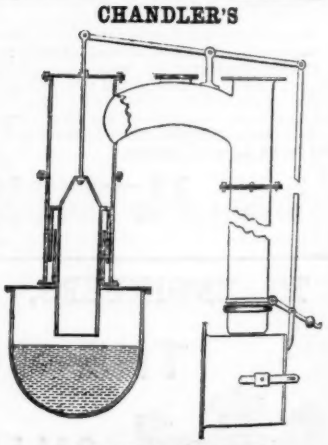

PATENT DIP-PIPE.

TO INVENTORS AND PATENTEES.

MR. W. H. BENNETT, having had considerable experience in matters connected with Gas, Water, and Sanitary Improvement, begs to say that he continues to assist Inventors in the perfection of their designs, and to obtain for them PROVISIONAL PROTECTION, whereby their invention may be secured for Six Months; or LETTERS PATENT, which are granted for Fourteen Years.

Patents completed, or proceeded with at any stage, thereby rendering it unnecessary for persons resident in the country to visit London.

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FOR PURIFIERS AND SCRUBBERS,

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CONTRACTOR FOR GAS APPARATUS & MAIN-LAYING.

THE THORNCLIFFE IMPROVED CENTRE-VALVE,

MANUFACTURED BY

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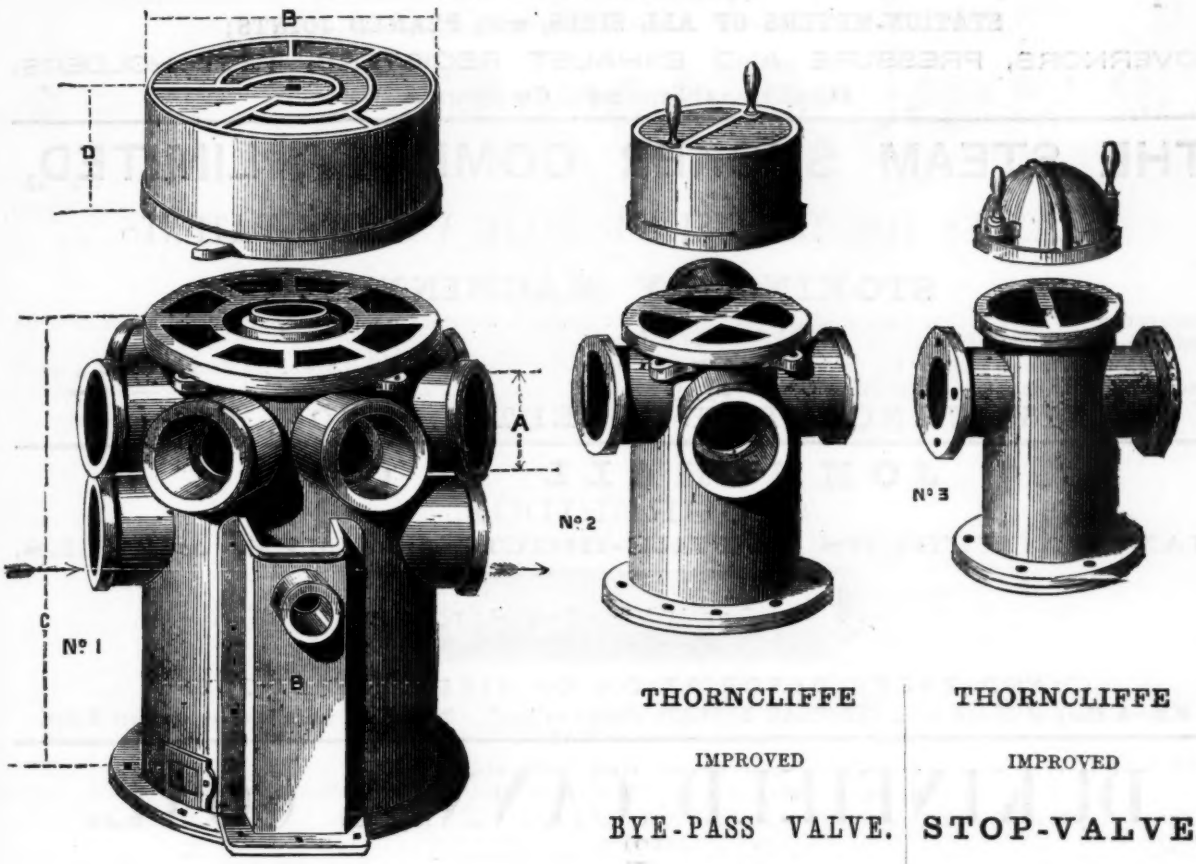
THORNCLIFFE IRON-WORKS, NEAR SHEFFIELD.



THORNCLIFFE IMPROVED BYE-PASS VALVE.

SIZES From 3 ins. upwards.

THORNCLIFFE IMPROVED STOP-VALVE.

SIZES From 3 ins. upwards.

Sizes of the THORNCLIFFE IMPROVED CENTRE-VALVE.

		Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.
A	Bore of Pipe...	4	5	6	7	8	9	10	12
B	Diam. of Body.	16	20	23	26	28	31	34	40
C	Height of Tank.	33	35	38	43	46	48	51	56
D	Depth of Cover.	8	9	10	11	12	13	14	16
	Total height...	41	44	48	54	58	61	65	72

In all cases the Covers are cast heavy enough to resist any required pressure.

The advantages derived from the adoption of these Valves are so manifest and cardinal that in the immediate character of the change—the simplicity of the machine—the facility affording for cleaning out connexions between Valve and Purifier—the perfect collection and delivery by suitable overflow of the ammonia, at a greatly diminished depth from ground-line over the old form of Valve—the advantage of connecting on the same level, and at any angle, or opposite to each other, the inlet and outlet pipes without dip or rise—the clear acquisition of space in the purifying-house, by being able to place the boxes nearer together, the new Valve being entirely under the floor—and lastly, though of the greatest importance, the passage of crude and unpurified gas during the change is minimized to the merest fraction, thus preventing the fouling by impure gas the delicate machinery and easily affected exposed movements of the station-meter, thereby preventing the introduction of the enemy (unpurified gas) into the gasholder. Also a dead abutment is offered to all back pressure, imparting thereby to the gauges, governors, and hydraulic seals, a steadiness of action never realized with the once famous, but now fast becoming obsolete, Hydraulic Centre-Valve.

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IMPROVED CONSUMERS WET GAS-METERS

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THE UNVARYING WATER-LINE GAS-METER,

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IMPROVED DRY GAS-METERS;

STATION-METERS OF ALL SIZES, with PLANED JOINTS;

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THE STEAM STOKER COMPANY, LIMITED,

ARE NOW PREPARED TO GRANT

LICENCES FOR THE USE OF THEIR VARIOUS PATENTS

FOR

STOKING BY MACHINERY.

Under one or the other of their Patents, Machines can be adapted to almost any existing works without material alteration of the Retort-Houses or Settings.

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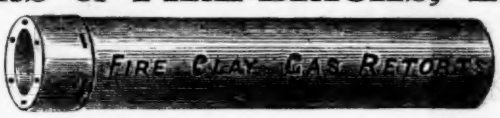
STOURBRIDGE,

MANUFACTURERS of FIRE-BRICKS, LUMPS, & TILES,



AND EVERY DESCRIPTION OF FIRE-CLAY GOODS.

N.B.—A Stock of 15 and 16 in. CIRCULAR RETORTS always on hand. Other kinds made to order on short Notice.

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THE DUNKIRK COAL COMPANY.

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NEAR LEEDS,

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Where is always kept a Stock of Retorts, Fire-Bricks, Terra Cotta Ware, and Drain-Pipes.

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SOLE MAKERS OF

MORTON'S PATENT SELF-SEALING RETORT-LIDS,

WITH

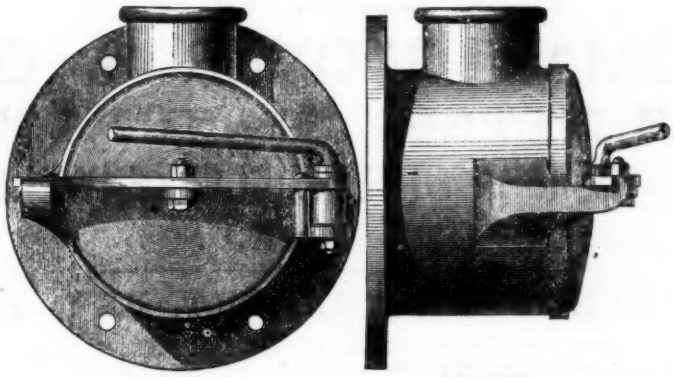
HOLMAN'S PATENT ECCENTRIC FASTENINGS.

OVER 7000 IN USE.

NO LUTING.

LIDS HINGED TO MOUTHPIECES; NO LIFTING ON OR OFF.

NO SCREWS FOR FASTENING.



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SIMPLE.

ECONOMICAL.

DURABLE

EFFECTIVE.

NO DUPLICATE LIDS REQUIRED.

These Lids are proved by many eminent Gas Engineers to be the most efficient, saving much time, labour, and expense; are opened and closed as quickly and with as little trouble as an ordinary furnace door, and by their use the Retorts are soundly sealed during the whole period of carbonization.

THESE LIDS ARE IN USE AT THE FOLLOWING (AMONG MANY OTHER) GAS-WORKS:—

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„ Gaslight Company, Bow Common.	„ Alliance and Dublin Gas-Works.	„ Newcastle-on-Tyne Gas-Works.
„ London Gaslight Company.	„ Edinburgh Gas-Works.	„ Carmarthen Gas-Works.
„ Independent Gaslight Company.	„ Manchester Corporation Gas-Works.	„ Merthyr Tydfil Gas-Works.
„ Phœnix Gaslight Company.	„ Salford Corporation Gas-Works.	„ Ystrad Gas-Works.
„ South Metropolitan Gaslight Company.	„ Rochdale Corporation Gas-Works.	„ St. Alban's Gas-Works.
„ West Ham Gas Company.	„ Liverpool United Gas-Works.	„ Over Darwen Gas-Works.
	„ Birkenhead Gas-Works.	„ Aylesbury Gas-Works.

The Morton's Lid is made circular in form, that being the most convenient and suitable shape. It can be used for Retorts of any section, by adapting the Mouthpiece casting from the D, oval, or other shape, at the back, to circular in front.

The following important Testimonial, among others, has been given:—

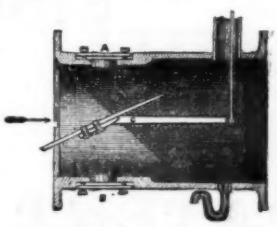
The Gaslight and Coke Company. Engineer's Office, 6, Westminster Chambers, Nov. 14, 1871.

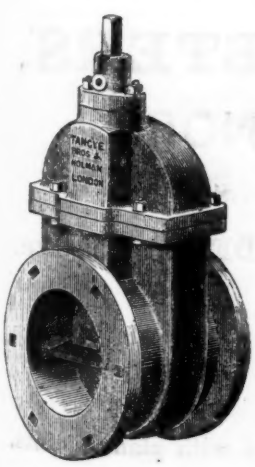
Dear Sir,—In reply to your inquiry, I have the pleasure of stating that the whole of the Mouthpieces at Beckton have Morton's Lids attached to them, and they have given us every satisfaction. We have 2160 in use.—I remain, yours truly, (Signed) F. J. Evans.

SOLE MAKERS OF

HUNT'S PATENT EQUILIBRIUM GAS-GOVERNOR.

In this Governor a Throttle-Valve is substituted for the ordinary suspended Cone, all external communication being avoided by placing the Lever or Radius Arm (shown at C on the drawing) inside the Valve-Chamber, upon the Disc. The Disc is carried upon steel centres, upon which it is accurately balanced and turns freely. The friction in working is thereby reduced to a minimum. This Governor is extremely sensitive to alterations of inlet or outlet pressure, and renders a large actuating holder unnecessary.





London Gas-Works, Nine Elms, Dec. 25, 1871.

Gentlemen,—The 18-inch Hunt's Patent Throttle-Valve Governor supplied by you to this Company has been in use for about six months, working very satisfactorily; it obviates entirely the oscillation which sometimes occurs with the ordinary Governors, with the annoyance and danger arising therefrom. The efficiency of this Instrument, together with its compactness and lowness of price, ought to ensure its general adoption.

Messrs. Tangye Brothers and Holman. (Signed) Robert Morton, *Engineer.*

TANGYE BROTHERS AND HOLMAN

Have in Stock, and ready for immediate delivery, the following GAS-VALVES:—

20 3-inch Rack Valves.	9 6-inch Screw Valves.	13 10-inch Screw Valves.
7 4 „ Screw Valves.	14 8 „ „	12 12 „ „
10 5 „ „	10 9 „ „	14 14 „ „

CLELAND'S PATENT DIRECT STEAM-JET EXHAUSTERS.

TRAVELLERS AND HYDRAULIC LIFTS FOR PURIFIER-LIDS, &c.

London 1851. New York, 1853. Paris, 1855. London, 1862.

Dublin, 1865.

The SIX MEDALS AWARDED to THOMAS GLOVER for

PATENT DRY GAS-METERS,

The latter being the Highest Medal awarded for Dry Gas-Meters by the Imperial Commissioners for the Universal Exhibition, Paris, 1867.

Paris, 1867.

THOMAS GLOVER & CO.,

DRY GAS-METER MANUFACTURERS,

214 TO 222, ST. JOHN STREET, CLERKENWELL GREEN,

LONDON, E.C.

THOMAS GLOVER & CO.'S PATENT DRY GAS-METERS,

1st, Are a remedy for all the defects of Wet Meters;
2nd, Are suitable for all climates, whether hot or cold;
3rd, Incur no loss of Gas by evaporation;
4th, Cannot become fixed by frost, however severe;
5th, Are the most accurate and unvarying measurers of Gas;
6th, Prevent jumping or unexpected extinction of the Lights;
7th, May be fixed either above or below the level of the Lights;
8th, Cannot be tampered with, without visibly damaging the outer case;
9th, Will last much longer than Wet Meters;
10th, Will not cost more than one-half for repair that Wet or Water Meters do;
Are upheld for five years without charge.

WILLIAM PARKINSON & CO.,

(SUCCESSORS TO SAMUEL CROSLEY,)

COTTAGE LANE, CITY ROAD, LONDON, E.C.

Established 1816.

MANUFACTURERS OF

PATENT WET & DRY METERS,

STATION-METERS AND GOVERNORS,

PRESSURE REGISTERS, GAUGES,

EXPERIMENTAL METERS, PHOTOMETERS, GASHOLDERS, &c., &c.

WATER METERS.

W. P. & Co. beg to state that they are now prepared to supply Station-Meters with planed joints.

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TO CORRESPONDENTS.

No notice can be taken of anonymous communications. Whatever is intended for insertion, must be authenticated by the name and address of the writer; not necessarily for publication, but as a guarantee of good faith.

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THE JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, JULY 1, 1873.

Notes upon Passing Events.

THE most prominent event of the day is the visit of the Shah of Persia. He has been received with more attention and more enthusiasm than any monarch who has visited this country since the Allied Sovereigns, accompanied by Blucher, were fêted and feasted here after the battle of Waterloo. They were allies in a struggle for existence which ended in a crowning victory, and, for the moment, made England appear the arbiter of Europe; that excited enthusiasm. They were foreigners; we were not, at that time, accustomed to travel and see foreign costumes; and that excited curiosity. Amongst the distinguished visitors glittering in stars and decorations next to Blucher, hot from the field of Waterloo, none excited more attention than the semi-savage Cossack generals in the suite of our tall, plausible, and utterly false ally, the Emperor Alexander. Since that date we have entertained the Emperor Nicholas; Louis Philippe, King of the French; Louis Napoleon, Emperor of the same fickle people; the King of Sardinia, since of Italy, who represented an idea pleasant to the English mind; the Sultan of Turkey, and the Khedive of Egypt. We feasted them all, bored them all with deputations and addresses, showed them reviews of a handful of choice troops, and presented them with the freedom of the City of London in gold boxes. But for none of these imperial and royal personages have we done so much as for the autocrat of Persia, who occupies in his vast and barren territory at once the position of a despotic Emperor and a Pope—above all law, and chief of all the religion of the country. The cause of this enthusiastic reception, in which the Heir Apparent of the Autocrat of all the Russias—a much more wealthy and powerful monarch—becomes a secondary personage, is, according to the great Sir Robert Peel's definition, threefold. In the first place, to the populace this dark, impassive Oriental covered with precious stones is something quite new. He realizes the stories of the "Arabian Nights," or of the penny sensational periodicals. They see a king in whose hands are life and death and all that we call justice. The Sultan was nominally as complete an autocrat, but he has been tamed by treaties and subdued by ambassadors and newspapers. Constantinople is too close to European States to retain the ways of good "Alrhoun Alraschid." The king who can cut off a head of this man, and order that man to be bastinadoed, with a nod, who has a harem of a hundred or so, and rides a white Arab with a pink tail, on a saddle worth a thousand pounds, is a natural object of mob curiosity, and the mob includes all classes anxious to see something new, strange, and mysterious. There is another class quite removed from the street crowds, who regard the Shah's visit with as much interest as curiosity. This is the great speculating world, who have heard of railway shares and loans, mines of rubies and emeralds, copper, lead, and silver, forests of incalculable value waiting to be cut down, ports and harbours to be developed, premiums and patronage to be brought upon European markets. Baron Reuter, who commenced so humbly, a few years ago, an enterprise for utilizing telegraphic power in the interest of the European press, has become, in the eyes of the speculative world, a personage of the highest importance. To him is due the visit of the Shah, for that visit is to be the foundation of endless schemes of joint-stock enterprise—as Dr. Samuel Johnson phrased it, in reference to the sale of old Thrale's brewery, "A potentiality of wealth beyond the dreams "of avarice." A newspaper which every evening faithfully presents the views of "*very superior persons*" on every subject, has endeavoured to damp these golden dreams by pointing out with disagreeable geographical precision, that the population of Persia is sparse, and either nomadic or poor and lazy, and that the country is ill-cultivated and divided by barren deserts. All this may or may not be true, but it will not affect the value of Persia as a field for speculation. The time is rapidly approaching when a speculative epoch is due. South America was the first sponge for British accumulations of capital after the great Peace of 1815, and California, with its Silver Hills and Emma Mine, the last. Something must be found to reduce the British plethora of savings and profits, and Persia, being least known, is most appropriate. Still is the maxim true, "*Omne ignotum pro magnifico.*" There is a very plausible, and possibly true, answer to the *Pall Mall Gazette's* disparaging comments on Persian investments. Australia is almost a continent in dimensions, it is still thinly populated, it is intersected with deserts, yet it has yielded great treasures in gold and other metals, and has in one province, at any rate (Victoria), derived extraordinary benefit from unpaying railways. We shall soon learn whether there are any resources, mineral or agricultural, to justify the construction of Persian railways; a passenger traffic can scarcely be counted on. The third cause of the interest which Englishmen take in Persia, and which, acting most strongly on the Government, induces it to go to unusual pains and cost in entertaining the Shah, is purely political. The empire of India cannot but be affected by the Government of Persia, and Government means the Shah. The Russian organs of the war party are perfectly right when they assert that we are trying to show the Persian monarch that we are more powerful than the Czar, whose soldiers are numbered by hundreds of thousands, and that he will be wise to be friendly with us. Thus political plans, financial schemes, and popular curiosity combine to make the visit of this semi-barbarous sultan of a poverty-stricken, but undeveloped, country a very grand affair. We cannot help observing that the astonishment created by the Shah's jewels is somewhat childish. If any of our noble millionaires were to put half their fortunes in diamonds, emeralds, and rubies, instead of land, houses, shares, and stocks, they would make an equal, or superior, display.

There is perhaps no metropolitan question that excites more real interest than that of abolishing the tolls between Waterloo Bridge and Kew lately freed. The Metropolitan Board have failed in one attempt through the opposition of the Corporation of London and the fantastic squeamishness of Mr. Gladstone, which would not sanction, in defiance of the City, the continuance of the coal-tax. A committee of the Common Council, holding a common-sense view that doing was better than talking, and that freeing the bridges was more beneficial to the City than miscellaneous feasting, came to a provisional agreement with the Metropolitan Board for raising the money required to buy up the toll bridges by using the borrowing powers of the board assisted by the guarantee of the Corporation; but when this very wise report was brought before the Common Council, John Wilkes's prophecy proved true—"the nonsense "beat the sense of the Council by two to one." Sir Francis Truscott, Alderman and Sheriff, faithfully represented the ignorant prejudices which are so steadily bringing this ancient Corporation into contempt. He treated the Metropolitan Board as an unclean thing, with which the high and mighty citizens should have nothing to do. He argued as Lord Eldon used to argue—that if our Dissenters were allowed to be Town Councillors and Aldermen, the Throne and the Church would no longer be safe—that if the Common Council once made a friendly contract with the Metropolitan Board, the Corporation would shortly be strangled in boa-constrictor-like folds. Stupidity could not see that if the bridges were freed the public would give the credit to the most prominent body in the transaction. The Lord Mayor, Aldermen, and Common Councilmen, in their robes, would quite overshadow the plain coats of Colonel Hogg and his colleagues; so stupidity had its own way. When next the Metropolitan Board frames a bridge emancipation scheme for the approval of Parliament—and doing such work is the reason of its existence—Colonel Hogg will be able to state before a committee, and argue in the House of Commons, that his Board had done its best to find a *modus vivendi*, with the Corporation of London, for the benefit of the public, but found it impossible.

The Corporation cut a good figure entertaining the Shah at Guildhall, which, since the construction of the library, is well suited for the purpose; but if economy is the order of the day, and money cannot be found for important City objects, one cannot help asking why, whenever the Lord Mayor entertains a distinguished guest, he

is also compelled to invite from a thousand to twelve hundred middle-class tradesmen—their male and female relations at the same time. If these feasts were confined to illustrious and distinguished guests, the Lord Mayor's £10,000 a year would be sufficient for all really needful hospitality. The cost of the perquisites of every member of Common Council in luncheons, dinners, and banquets, would pretty nearly pay the working expenses of the Corporations of Liverpool and Manchester. What it would cost to extend the same system to the House of Commons would be a nice arithmetical question for some City charity boy to calculate.

The superior management of foreign, and especially French railways, has long been a standing text for the habitual vilifiers of the private enterprise that has created the British railway system. To be sure the only system the Chadwicks and the Hills approve is one like the Post-Office, where no liability exists for loss—where no compensation can be claimed for the delay of a telegram or the appropriation of a registered letter. Half the people who praise the continental railway system only know it as idle travellers, not in haste, and not burdened with the responsibilities of merchandise. Here is a sketch of the present condition of railway traffic in France, famed for its able administration.

There are only three fast trains each way per day between Calais and Boulogne and Paris, and only the same number between Paris and the great manufacturing and producing districts of Lyons and Marseilles, while between Liverpool and Manchester and London by the three competing routes there are 20 trains each way per day, so that the public have every choice of time. Our lines receive goods at Manchester up to 7 o'clock at night, and they are delivered into the warehouses in the City before 8 next morning; whereas the *grande vitesse* business between Paris and Boulogne (157 miles), as against our Great Northern route (202 miles), takes two days, and *petite vitesse* goods a week. About a year back it was announced that the Chemin de Fer du Nord had at last undertaken to lay down rails to the Quai Bonaparte at Boulogne, by which the tidal service would be worked *quai à bord*, as at Dover. This would save, on an average, from an hour to an hour and a half in the journey, and admit of its being completed, in fine weather, in eight hours and a half instead of ten hours. But it now appears that, after months of urgent pressure from this side, their executive met at Boulogne last Thursday, and finally decided to do nothing, the excuse being that the South-Eastern Company are applying for a concession to improve Boulogne Harbour. As yet it is by no means certain that the company will get the concession, or that if they get it they will be allowed to carry it out, and in any case, if carried out, it will take seven years to complete. The cost of the improvement suggested would be about £3000, and, apart from the danger, delay, and inconvenience, the annual cost of carts, vans, &c., which would be saved is at least £1500.

In the meantime, under that system of monopoly which our railway doctrinaires tried to introduce in England, the Nord pays 16 per cent., the Mediterranean 17 per cent., and railway travellers whose luggage is missent or stolen are refused all redress.

The latest antiquarian absurdity has been reached in a cry from a young nobleman of taste. Following the footsteps of Earl Stanhope, he invites the Government or the public to spend twenty or thirty thousand pounds in preserving the "Tabard Inn" in the Borough, from which Chaucer's pilgrims did *not* set out on their road to Canterbury. The suggestion is excusable as regards Lord Ronald Gower, who is young, enthusiastic, and not perhaps very conscious of the value of money; but the very idea is wrong. No spot can remain sacred to a poetic idea in a site devoted to busy traffic. It is very pleasant to take the lead in spending other people's money, hence the zeal to rescue old monuments from oblivion and establish new ones. If the "Tabard," which, it seems, was really rebuilt in 1667, could be preserved, it would not be nearly so good a monument to Chaucer as a fine edition of his works.

Several of the reorganization schemes of the Endowed Schools Commissioners having been strenuously, and, in two or three instances, successfully attacked, Mr. Forster, with his usual conciliatory good temper, before applying for a renewal of the powers of the commissioners, obtained the appointment of a select committee to inquire into their past transactions. This committee has just made its report, and recommends the renewal of the commission with certain restrictions and modifications, introduced as variations if not amendments of the chairman's report, which are meant to condemn the manner in which the commissioners have performed their work, rather than the work they have done and proposed to do. The committee proposes that the power of making and approving schemes for the management of endowed schools be extended for three years, but they observe that "the published opinions of some of the commissioners on the "subject of endowments have in some instances seriously impeded the "harmonious action between them and the governing bodies of the "charities." The fact is that the chairman of the commission is, although a learned, honest, and well-meaning man, so utterly deficient in tact, temper, and the courtesy expected from a modern nobleman, so inarticulate in speech, and so "abnormal"—we use his own word—in his gestures and the contortions of his countenance, that deputations are sent away alarmed and disgusted, instead of soothed and satisfied as they would be by seeing Mr. Gladstone, Lord Granville, Mr. Forster, or even Mr. Lowe (of late). The time during which objections may be received is reduced from three to two months, while the time that a scheme must be before Parliament before being sanctioned is very properly extended from 40 days to 60 days. In some directions it is recommended that the powers of the commission should be extended; but, after all, the best amendment of the commission would be the appointment of a new chairman, of the modern courteous school, and perhaps a new secretary.

ADVANCES IN THE PRICE OF GAS.—At Elland and Ossett (Yorks) the price of gas has been advanced from 4s. 2d. to 4s. 7d.; Ramsgate and Margate from 4s. 6d. to 5s.; Kirkintilloch from 5s. 10d. to 6s. 8d.; and Perth to 7s. 6d.

SOCIETY OF ARTS.—The council have awarded the society's medal to Mr. Thomas Wills, F.C.S., for his paper read at one of the evening meetings, which was reported in this JOURNAL on the 3rd ult., entitled, "On some Recent Processes for the Manufacture of Gas for Illuminating Purposes."

Circular to Gas Companies.

THE Government have not proceeded with the Municipal Corporations (Borough Funds) Amendment Bill with the haste at first threatened. The order for the second reading on the 19th was dropped, and it has only appeared again for yesterday, and the Bill may be advanced a stage at the time these lines are going to press. In the meantime we are glad to see that a considerable number of petitions against it have been presented by gas and water companies. Knowing perfectly well that the original measure was, and that this more especially is, inimical to the interests of gas and water companies, we have, however, always treated the matter as a ratepayers question, and we should have been glad to see the companies using their influence and intelligence in setting before their customers, the ratepayers, the true bearings of the measure on their interests.

It must be remembered that the measure is pressed upon the Government by only two or three Corporations, who are hankering for the possession of gas and water undertakings, notoriously against the wishes of a majority of their constituents, and who have hitherto failed to obtain them by the means at their disposal. They now seek for power to continue the contest by an unlimited expenditure of corporate funds. They are backed up in this attempt by other Corporations, like that of Manchester, who do not require the measure, and who are only actuated by what we may call an *esprit de Corporations*. We strongly urge upon our readers the duty of continuing their opposition to the passing of this Bill by all legitimate and constitutional means, not only in the House of Commons, in which the Government, if in earnest, may be strong enough to carry the measure, but in the House of Lords also, who may be persuaded to take a different view of the question. Five members of the House of Commons have severally given notice of a motion which, if carried, involves the rejection of the Bill; but, as we have said, if the Government persist, it may be carried notwithstanding.

The Brighton and Hove Gas Bill has, in opposition to the Corporation of Brighton, passed a committee of the House of Lords without material alteration. Our readers will remember that it is promoted by the company to obtain an advanced maximum price to the extent of 1s. per 1000. The committee of the House of Commons granted what they considered was equivalent to an advance of 1s. per 1000—viz., 6d. in money, and the new London as a test burner, which was believed equal to another 6d., since 12-candle gas by the old burner might be represented as 14-candle by the new. The assumption was that the difference between 12 and 14 candle gas is worth 3d. per candle, which every practical gas maker knows to be utterly fallacious. It is much nearer the mark to say that the value per candle within these narrow limits is abont 1d., and the advance granted by the Commons committee amounts practically to only 8d. What effect will be produced on the dividend of the company cannot be accurately known until the end of the year, but we believe it will be quite low enough to please Lord Redesdale. It will be seen that the increased price is only granted for the current year, and that application must be made to the Board of Trade if it be desired to continue the advanced rate. This is following the precedent established in the most recent metropolitan Acts. It is late in the session, but there is yet time for the Board of Trade to introduce a short general measure authorizing the Board to consent to additions to maximum price after proper investigation. Why the Board should be allowed to exercise this power in favour of four companies, while all the other gas companies in the kingdom are denied the advantage of such a provision, must be a mystery to all but those who make our laws. Something, however, will have to be done next year. The prospect of cheap coal seems to get more and more remote, and another year of high prices will reduce numerous companies to actual bankruptcy. People are too apt to conceive of a gas company as an individual, and to show little pity for his misfortunes. They forget that a company represents an aggregate of shareholders, many of whom have their whole savings, and some their whole property, invested in the undertaking, and no dividends means a very widely spread loss to the community.

The Bill of the Chartered Gas Company has also passed a committee of the House of Lords, without serious alteration, notwithstanding the opposition of the Metropolitan Board of Works and of Mr. Leslie, who objected *in propriâ personâ*. We have no wish to make much of the vagaries of this gentleman, who has recently made himself conspicuously ridiculous, but we may express a hope that the vestry afflicted with him have at last seen the folly of allowing him to dictate their relations with the gas company. They good-naturedly allowed him to make use of the name of the vestry to enable him to appear before the Lords committee, but very sensibly declined to expend any money in support of the petition presented.

By a peddling "amendment" made to the Bill, the company are prohibited from paying more than 7 per cent. on the capital invested in collier ships so long as they charge more for gas than the maximum price fixed by the Act of 1868. This simply gives trouble to the company, while it cannot, in the remotest degree affect the price of gas. Supposing the whole sum authorized (£150,000) to be expended in ships, the difference made is only £4500.

The powerful opposition of the Corporation of Glasgow prevailed against the Partick and Maryhill Gas Company, who lost their Bill in the Lords, although it was carried in the Commons after a very full inquiry.

The papers read at the recent meeting of the British Association of Gas Managers by Mr. Warner and Mr. Emmerson, which we publish to-day, with the discussion which followed, will be read with much interest. There can be no doubt that the complete and perfect register of distributing plant, proposed by Mr. Warner, would be most valuable to a gas company, and would well repay the trouble

expended in its compilation. It would not, of course, supersede the map which every company should have, and many are compelled to keep; but the register might save the expense of a map drawn on a large scale. The plan proposed is very elaborate; but, if worth doing at all, such work is best well done. Another thing clearly shown in this paper is the necessity for exercising greater control over, and for making more frequent inspection of meters. We fear the meter list published by Mr. Warner represents a state of things common in many towns other than that in which it was compiled.

Mr. Emmerson's paper gives a general review of the causes and remedies for unaccounted-for gas, to which nothing need be added. The matter is of so much importance to gas companies that it is no wonder the two papers we have named provoked a most interesting, and we must add an exhaustive, discussion. The immense importance of the question is shown in the case of the Chartered Company, who admit a loss of £60,000 worth of gas a year. The loss in their case no doubt arises chiefly from two sources—actual leakage from the mains and defective registration of meters. We take it as a fact that there is no great loss from public lights in London, though we know the loss from this source is large in many country towns. It may or may not be impossible, as Mr. Anderson says it is, to avoid leakage in works from 40 to 50 years old, still it is a question whether it would not pay the Chartered Company better to expend some capital in overhauling their mains rather than in the purchase of collier ships to effect a doubtful saving of £10,000 a year in freights. The papers and discussion we report cannot but be beneficial to all gas companies, who have now before them a complete account of the various causes of loss, and the remedies to be applied. We may say a word, in conclusion, in favour of the system of districting proposed by Mr. Warner, which will prove most useful wherever it can be adopted. The expense will be an obstacle to its adoption by old companies, but, as the author points out, the system may be brought into use gradually as renewals are needed, without much greater outlay than would be required for works absolutely necessary.

In yesterday's commercial intelligence is the announcement of another rise in the price of coal at Sheffield, and in Staffordshire an early crisis in the iron trade is prophesied. The coalowners are said to be diminishing the output according to the lessened demand for domestic consumption, the object being to keep up the price to the ironmasters. Altogether, as we have said above, the prospects of lower prices for coal seem distant.

A company to take over Mr. Kromschroeder's air carburetting patents was registered last week, but the prospectus is not yet before the public. The capital is to be £120,000, in £1 shares. Mr. Kromschroeder was earlier in the field than most of his present rivals, and some of his arrangements exhibit great ingenuity. We do not, however, consider the fate of all air carburetting schemes as at all doubtful.

Correspondence.

A PROBLEM.

SIR,—Will some of your scientific readers solve the following problem, and state how they arrive at their result:—

A gas-meter fixed at the bottom of a hill is supplied with gas which is afterwards passed through a meter fixed at the top, the difference of level being 100 feet. The specific gravity of the gas is 470, and the temperature at which the gas is measured is the same in both meters.

The gas is burned in a house in the usual manner.

The question to be answered is, What will be the registration of the two meters?

June 24, 1873. RATHER PUZZLED.

Parliamentary Intelligence.

HOUSE OF LORDS.

MONDAY, JUNE 16, 1873.

The following bills received the Royal Assent by commission:—

Stockton-on-Tees Gas.	Harrow Gas.
Over Darwen Local Board of Health.	Sutton Southcoates and Drypool Gas.
Bournemouth Gas and Water.	Colne Valley Water.

AIR BURGH BILL.—Petitions against this bill were presented by owners, &c., of property in Newton, &c., and by the Ayr Water Company.

THE GASLIGHT AND COKE COMPANY.—A petition against this bill was presented by the Vestry of St. Mary Abbott's, Kensington.

PARTICK, HILLHEAD, AND MARYHILL GAS.—Petitions against this bill were presented by the Provost, &c., of Govan; and in favour of it by the Provosts of Crosshill, Hillhead, Kenningpark, Maryhill, and Partick.

TUESDAY, JUNE 17.

DEWSBURY AND BATLEY CORPORATIONS GAS BILL.—The Chairman of Committees informed the House that the opposition to this bill was withdrawn.

Dewsbury and Batley Corporations Gas, Nottingham Gas, Trowbridge Water, Ayr Burgh, and Glasgow Corporation Burgh Bills, were read second time, and committed.

BRIGHTON AND HOVE GAS BILL.—Reported from the Select Committee, with amendments.

ATHERTON LOCAL BOARD BILL.—Reported, without amendment.

UXBRIDGE AND HILLINGDON GAS BILL.—Report, that the Standing Orders not complied with in respect of this bill ought to be dispensed with, and the bill allowed to proceed, read and agreed to.

DUMBARTON BURGH BILL.—Report from the Select Committee, that they had not proceeded with the consideration of the bill, no parties having appeared in opposition thereto, read and ordered to lie on the table. The orders made on the 12th and 13th inst. discharged, and the bill committed.

Gas and Water Provisional Orders Confirmation (No. 2), and Belfast Gas Bills returned from the Commons, with the amendments agreed to.

THURSDAY, JUNE 19.

The Gaslight and Coke Company Bill was reported from the Select Committee, with amendments.

Uxbridge and Hillingdon Gas Bill read second time, and committed.

Lincoln Gas and Newcastle-upon-Tyne and Gateshead Gas Bills reported, with amendments.

PARTICK, HILLHEAD, AND MARYHILL GAS.—Report from the Select Committee was read, that it is not expedient to proceed with this bill.

FRIDAY, JUNE 20.

TROWBRIDGE WATER.—The Chairman of Committees informed the House that the opposition to this bill was withdrawn. The order made on Tuesday, June 17, was discharged, and the bill committed for Thursday, June 26.

Atherton Local Board Bill read third time, and passed.

Brighton and Hove Gas Bill read third time, with the amendments, passed, and sent to the Commons.

Doncaster Corporation Water Bill reported from the Select Committee with amendments.

Durham Gas Bill returned from the Commons agreed to, with amendments. The said amendments considered, and agreed to.

Ayr Burgh Bill referred to a Select Committee, consisting of Earl Bradford, Viscount Strathallan, Viscount Sidmouth (chairman), Lord Delamere, and Lord Templemore; to meet on Thursday, June 26.

THE GASLIGHT AND COKE COMPANY BILL.—A petition against this bill was presented from a meeting of inhabitants of St. Mary Abbott's, Kensington (signed by the chairman).

MONDAY, JUNE 23.

GLASGOW CORPORATION GAS BILL.—The committee on this bill to meet on Thursday, June 26.

The Gaslight and Coke Company, Lincoln Gas, and Newcastle-upon-Tyne and Gateshead Gas Bills were read third time, with the amendments, passed, and sent to the Commons.

DONCASTER CORPORATION WATER BILL.—A petition in favour of the amendments of this bill was presented from the ratepayers, &c., of Doncaster, in public meeting assembled (signed by the chairman and secretary).

THURSDAY, JUNE 26.

BARROW-IN-FURNESS CORPORATION BILL.—Reported specially from the Select Committee, without amendment.

DONCASTER CORPORATION WATER BILL.—Read third time, with the amendments, passed, and sent to the Commons.

Trowbridge Water and Uxbridge and Hillingdon Gas Bills reported, with amendments.

Glasgow Corporation Gas Bill reported, without amendment.

FRIDAY, JUNE 27.

DUMBARTON BURGH BILL.—The Queen's consent signified, and bill reported, with amendments.

PORTSMOUTH BOROUGH WATER BILL.—Returned from the Commons, agreed to.

POLLUTION OF RIVERS BILL.—A petition in favour of this bill was presented from the Board of Conservators of the Ribble Fishery District.

Wrexham and East Denbighshire Water Bill referred to a Select Committee, consisting of the Duke of Buckingham (chairman), Marquis of Westminster, Lord Eliot, Lord Leigh, and Lord Hylton; to meet on Wednesday, July 2.

HOUSE OF COMMONS.

MONDAY, JUNE 16.

BELFAST GAS BILL.—Lords amendments agreed to.

Durham Gas Bill (Lords), as amended, considered; amendments made, bill to be read third time.

GAS AND WATER PROVISIONAL ORDERS CONFIRMATION (No. 2) BILL.—Lords amendments considered and agreed to.

GOSPORT GAS BILL (LORDS).—Report, that no Standing Orders not previously inquired into are applicable; laid on the table. Bill to be read second time.

TUESDAY, JUNE 17.

MID LOTHIAN WATER BILL (LORDS).—Petitions were presented against this bill by inhabitants of Innerleithen, Manor, Peebles, and Walkerburn.

THURSDAY, JUNE 19.

MUNICIPAL CORPORATIONS (BOROUGH FUNDS) BILL.—Second reading deferred till Thursday, June 26.

Durham Gas Bill (Lords) read third time, and passed, with amendments.

ATHERTON GAS BILL.—Order of February 11, that this bill be referred to the Examiners of Petitions for Private Bills, read and discharged. Bill withdrawn.

Portsmouth Borough Water (Lords) and Briton Ferry Local Board (Lords) Bills reported, without amendment.

FRIDAY, JUNE 20.

MUNICIPAL CORPORATIONS (BOROUGH FUNDS) BILL.—Petitions for alteration were presented from the following gas or water companies:—Coventry, Dukinfield, Birmingham (two), Derby, Bath, Colney Hatch, Beccles, St. Helen's, Wakefield (two), Brierly Hill, and Torquay.

MONDAY, JUNE 23.

Gosport Gas Bill (Lords) read second time, and committed.

MUNICIPAL CORPORATIONS (BOROUGH FUNDS) BILL.—Petitions for alteration of this bill were presented from the following gas companies, viz.:—Great, Yarmouth, Cheltenham, Edinburgh, Lancaster, Thirsk, Altrincham, Whitby Gravesend and Milton, Dewsbury and Batley, Haslingden, Southampton, Stratford, Dudley, Devonport, Kingston-upon-Thames, Maryport Town and Harbour, Mirfield, and Croydon Commercial. Also from the following water companies, viz:—Nottingham and Rosendale; and from the Pontypool Gas and Water Company.

MID LOTHIAN WATER BILL (LORDS).—Petitions in favour of this bill were presented from the Provosts, &c., of Portobello and Leith, the Leith Chamber of Commerce, the Leith Shipowners Society, the Dalkeith Local Authority and householders, and from inhabitants of Granton, Millerhill, Musselburgh, Loanhead and Silmerton, &c.

THURSDAY, JUNE 25.

MUNICIPAL CORPORATIONS (BOROUGH FUNDS) BILL.—Petitions for alteration were presented from the following gas companies, viz.:—Warrington, Leominster, Ipswich, and Hythe and Sandgate.

WEDNESDAY, JUNE 25.

MUNICIPAL CORPORATIONS (BOROUGH FUNDS) BILL.—Petitions for alteration were presented from Cambridge, Durham, and Nottingham; and from the following gas companies, viz.:—Stratford-upon-Avon, Dover, Leamington Priors, Stourbridge, Sutton and Drypool, Sheffield United, Elland-cum-Greetland, Shipley, Barnstaple, Derby, Boston, Canterbury, Exeter, Brentford, and King's Lynn.

THURSDAY, JUNE 26.

PORTSMOUTH BOROUGH WATER BILL (LORDS).—Read a third time, and passed.

MUNICIPAL CORPORATIONS (BOROUGH FUNDS) BILL.—Petitions against this bill were presented from Sheffield, Tamworth, Faversham, Taunton, Falmouth, Brighton and Hove, Wilmslow and Alderley Edge, West Ham, Ossett, Norwich, Stalybridge, Aldershot, and from the Newcastle and Gateshead Water Company.

DUN DRAINAGE BILL (LORDS).—Reported with amendments.

MUNICIPAL CORPORATIONS (BOROUGH FUNDS) BILL.—Second reading deferred till Friday, June 27. Viscount Mahon, Mr. Joshua Feilden, Mr. Craufurd, Mr. Mellor, and Mr. Eykyn severally gave notice, on motion for second reading, to move—"That the bill be read a second time upon this day three months."

FRIDAY, JUNE 27.

THE GASLIGHT AND COKE COMPANY, LINCOLN GAS, AND NEWCASTLE-UPON-TYNE AND GATESHEAD GAS BILLS.—Lords amendments agreed to.

MUNICIPAL CORPORATIONS (BOROUGH FUNDS) BILL.—Petitions for alteration were presented from Coventry and Newcastle, from the South Shields Gas Company, the Great Yarmouth Water-Works Company, and the Lowestoft Water, Gas, and Market Company.

MUNICIPAL CORPORATIONS (BOROUGH FUNDS) BILL.—Second reading deferred till Monday, June 30.

BRADFORD IMPROVEMENT BILL (LORDS).—Reported with amendments.

HOUSE OF LORDS.

(*Before Earl* DEVON, *Chairman; Earl* MORTON, *Lord* ABERCROMBIE, *Lord* MONTEAGLE OF BRANDON, *and Lord* RAGLAN.)

MONDAY, JUNE 16.

BRIGHTON AND HOVE GAS BILL.

Mr. VAUGHAN RICHARDS, Q.C., and Mr. MICHAEL appeared for the promoters; Mr. DENNISON, Q.C., and Serjeant SARGOOD appeared for the Corporation of Brighton, who were the only petitioners against the bill.

Mr. RICHARDS, in opening the case for the promoters, said this was one of the first of the opposed bills which passed the House of Commons this session. The bill was of an extremely simple character, having for its object the increase of the price of gas in consequence of the enormous rise that had taken place within the last year or two in the price of every kind of material connected with the manufacture of gas, as well as the labour bestowed on that manufacture. There were two gas companies which lighted Brighton—the Brighton and Hove Gas Company, whose works were situated at the west end of the Brighton Esplanade; the other was the Blackrock Company, whose works were at the extreme east end of Kemp Town. The two companies have mains laid over a very large portion of Brighton. They were not at present in active and destructive competition, although they had the power of lighting Brighton, and at certain places of the town interlaced each other. In fact, Brighton enjoyed competition in gas in the best possible form—not a destructive, suicidal competition, such as invariably led to great loss to the companies, and ultimately to the prejudice of the consumers; but the Blackrock Company, having no limitation of price in their bill, were driven down to the same price as that which was fixed to be charged by the Brighton and Hove Company under their Act of 1866, by which Act they also obtained additional capital. In the same year the Aldrington, Brighton, and Hove Company sprang up. It called itself a consumers company, which was always a popular phrase. It was supported by the Corporation of Brighton. It offered to supply 14-candle gas at 3s. 6d., and to do a variety of things, easy of promise but difficult of performance; but this company had the effect of driving the Brighton and Hove Company down to accept 3s. 6d. as their maximum price. In 1869 two very large London companies, the Imperial and the South Metropolitan, obtained leave to charge 3s. 9d. for 14-candle gas, and if this was the price London companies were allowed to charge, 3s. 6d. was surely an extremely low price for Brighton. The Aldrington Company got their bill; but after they had succeeded in bringing down the price of gas in Brighton they never went any farther. Whether their present powers had lapsed or not he did not know; but, looking to the present price of material and labour, there was no probability of their doing anything now. In 1870 the Brighton and Hove Company came again to Parliament, but it was merely to obtain powers to remove their works a little farther from Brighton, as they were a nuisance to the town. They have, consequently, been removed from Adelaide Crescent to a point near Shoreham New Harbour, which is considerably to the west of the old site. A considerable amount of capital had been necessarily expended, but the interest on the capital has just been about equal to the saving in the carriage of coals from the new station as compared with the old one. The rate charged for the outlying districts was from 4s. to 5s. Under the bill of 1866 the Brighton and Hove Gas Company were restricted to the test of what was called the Birmingham burner, which shortly afterwards was proved to be a very inaccurate standard, and which has now become almost entirely obsolete. They proposed in their bill before the Commons to substitute Sugg's London No. 1 Argand burner, which was admitted on all hands to be the proper standard. When the bill was before the House of Commons, Mr. Denison, who represented the corporation, very ingeniously suggested that as 12-candle gas under the old test would rank as 14-candle under the new burner, and taking the value of each candle at 3d., the difference of the two candles would give the additional 6d. per 1000 to the company. We differed with Mr. Denison entirely; and although he addressed a powerful speech to the committee, he did not call any evidence on this point, which precluded us from making any remarks upon it. The House of Commons decided to give us Sugg's burner and 6d. extra, which they calculated would be worth 1s. Evidence, however, would be brought to show that the change of burner was not equal to 6d. Since the decision of the House of Commons, Lord Redesdale had laid it down that 5 per cent. was a fair and reasonable amount to obtain on any increased rate; 1s. of an increase would not give 5 per cent., while he doubted whether 6d. would save the company from actual bankruptcy. It was not to the interests of the public of Brighton—certainly not to the interests of the company—that the gas company should be in such a position as to be actually losing money, as in that case the lighting of the town would be ill conducted, and, if anything serious happened to the Brighton and Hove Company, the Blackrock Company would step into their shoes, and the latter company had no limitation whatever. The Corporation of Brighton, therefore, ought not to drive the company so closely as that they cannot get a reasonable return for their outlay. In 1866 Parliament were not passing a grim joke on the company when they fixed 3s. 6d. as the basis on which they could yield 10 per cent. upon their old capital, and 7 per cent. on their new. If 3s. 6d. was a fair and reasonable price when coal and other materials were so much lower in price than what they were at present, it was perfectly obvious that the article manufactured from these raw materials had become much more costly. The learned counsel then referred to the different clauses of the petition of the corporation. The amount of dividend paid on the capital in 1870 was 7 per cent. both on the old and the new capital. In 1871 the company paid the same amount; and in 1872 there was paid 10 per cent. on the old capital, and 7 per cent. on the capital of 1866. It would be found, on inquiry into the contracts, that they were at such a low price as enabled the company to give such a dividend, but they had run out since the bill was before the House of Commons. It was suggested in the petition that their lordships should inquire into the residual products, which consisted of coke, tar, and ammoniacal liquor. The price of coke was ruled to some extent by the price of coal; but unfortunately there were no manufactories in Brighton, and a large proportion of the population were of that well-to-do class who were not likely to burn coke. It was alleged that there would be virtually a monopoly. This he denied, as the Blackrock Company could run over Brighton if they chose. The petition also set forth that the company, by getting an increase in the price of gas would be keeping up their dividends at the expense of the public. Now, no one could deny that the company had exercised the greatest economy in the manufacture and distribution of their gas, and what he maintained was that, as raw material had risen to such an enormous extent, the company ought not to be ruined in order that the public might have their gas at an unjustifiably low rate. With regard to the other allegation, that the high price of coal will not be permanently maintained, the learned counsel remarked that the petitioners were very much ahead of their neighbours if they could undertake to say so. He would first ask their lordships to consider what relief the Brighton and Hove Company ought to have. He contended that the chairman of the House of Commons committee, in giving them 6d. and the Sugg burner, did not give them that shilling of increase which he had intended to give.

Mr. *Somers Clarke*, examined by Mr. RICHARDS.

I am a solicitor, and have practised in Brighton for 40 years. I have also been solicitor to the Brighton and Hove Gas Company for 30 years. The company was first established in the year 1825, and obtained their first Act in 1839, and obtained subsequent Acts in 1843, 1854, and 1866. In the Act of 1866 the price was limited to 3s. 6d. per 1000 feet, and in the same year the Aldrington, Brighton, and Hove Company introduced a bill. That bill was supported by the Corporation of Brighton. They proposed to supply 14-candle gas at 3s. 6d. We accepted the terms of 14-candle gas as they did.

Mr. RICHARDS: Have the Aldrington, Brighton, and Hove Company ever taken any steps for the construction of works?

Witness: No; their time has not expired yet, there is no compulsory clause in their bill. Their powers are "slumbering." In 1866 our works were situated at the back of Adelaide Crescent, at Cliftonville, in the parish of Hove. A large portion of Brighton itself is in the parish of Hove. Both the Blackrock Company and our company have the power of lighting Brighton proper, as also Hove and Preston. The mains of the two companies interlace in Brighton, but in point of fact we draw a boundary line between them, principally for the public lighting. We charge the same rate as the Brighton and Hove Company, which is the result of the competition between the two companies. It is not the fact, as stated in the petition of the corporation, that we have virtually a monopoly of Brighton. In 1870 we obtained power to erect works at Shoreham New Harbour. That incurred the outlay of a considerable amount of capital. By having the works removed we saved a considerable amount of money in the carriage of coal, which just about meets the interest on the extra capital expended.

By the CHAIRMAN: The distance between the old and the new site is about a mile and a half or two miles. The works are close to the harbour, and we get the coals from the ship's side.

Examination continued: The original capital of the company was £100,000, on which we are limited to pay 10 per cent. Besides that there is £25,000 ordinary capital, entitled to 7 per cent., and £50,000 preference capital, on which we pay 6 per cent. I am not a shareholder in the company. The two local authorities in Hove—the Brunswick Square Commissioners and the West Hove Improvement Commissioners—do not oppose this bill.

Cross-examined by Mr. DENISON: Did the Hove people take any part in the opposition of former bills?

Witness: I think not. The corporation supported the Aldrington Bill, and they opposed our bill in Parliament at the same time. We did not, as a consequence of that, volunteer a reduction in 1866; we reduced it because we were compelled to do so by the support which the other company was receiving.

Mr. DENISON: The result is that from your taking that price the Aldrington Company were never able to get into existence?

Witness: They never made any attempt to do so. If the Blackrock Company continue to supply gas at 3s. 6d., and if we raised our prices, no doubt we should lose customers; but my impression is if we raise the price they will do the same.

Re-examined by Mr. RICHARDS: We got to the mind of the committee before they came to their decision in 1866, and shaped our course accordingly. We did it under compulsion. The Aldrington maximum was 3s. 6d., to which we reduced our maximum.

Mr. *John Birch Paddon*, examined by Mr. MICHAEL.

I am a member of the Institution of Civil Engineers, and have been general manager of the Brighton and Hove Gas Company for the last thirteen years, and have had an experience of over thirty years in the construction and management of gas-works. The company was established in 1865, under the provisions of a trust deed. Up to the year 1871 the works were carried on at Hove. At that time their removal became imperatively necessary, as the inhabitants wished us to do so. A great deal of valuable property was erected near the works, and we were prevented from getting any more ground in Hove. We had an increasing trade, and we wanted to be on a site that would be unobjectionable. The removal of the works cost £72,000, about £65,000 of which was supplied by capital. The removal of the works had the effect of causing a reduction of about 3s. a ton in the price of coal. At the present rate of consumption the saving would balance the interest upon the outlay. When the works were at Hove we used to have to cart coals from the ships to the works, a distance of about a mile and a half, and had to pay a toll of about 1s. 3d. a ton, then 1d. per ton meterage. We now effect a considerable reduction by employing screw steamers instead of ordinary sailing vessels, which can be brought immediately in front of the works, and the coals raised from their hold by steam machinery, and thence conveyed by means of tramways deposited immediately in front of the retorts. The saving upon that is very considerable, and altogether it works at about 3s. per ton. The quantity of gas supplied to private consumers during the year ending December 1, 1871, was 175,357 cubic feet; for public lamps, 17,429,000 feet; making a total of 192,786,000 feet, as against 218 million; the difference of about 25 million being the unaccounted-for gas, which can be put at a per centage of 11·7.

Mr. RICHARDS: What becomes of the unaccounted-for gas?

Witness: Part of it is lost by leakage, part by meters, and part is consumed upon the works, in the offices, and so on. To my mind, a per centage of 11·7. shows a very satisfactory state of things. It is slightly under the average. In 1870 the per centage was 11·51. In 1869 it was 11·37, and we were even less last year. I cannot give the ordinary average of the London companies, but for many years it was considered that if 5-6ths of the gas made were sold it was a satisfactory amount. We are at least 2½ per cent. under the average. In 1871 the total cost of gas was 28·64d. per 1000 cubic feet; the total receipts were 44·21, leaving 15·57d. per 1000 feet profit. The amount of original ordinary capital that year was £100,000, £25,000 which was raised in 1866, and £42,500 preference capital. In the year 1872 we supplied to private consumers 185,804,000 feet; to public lamps, contracts, &c., 18,516,000; making a total of 204,321,000. The unaccounted-for gas amounted to about 24 millions, or 10·49 per cent. During that year we used 24,136 tons of coal, at an average price of 18s. per ton, the total cost being £21,747, equal to 25·5d. per 1000 feet. The residuary products amounted to £11,722, which is about 13·77d. per 1000. If that be taken from the cost of coal, it leaves a net expenditure of £10,025, or 11·7d. per 1000. The cost of production was 29·84d., the sum received being 44·12d., leaving a profit of 14·28d. In that year the preference stock was raised from £42,000 to £50,000, which exhausted the capital powers of the company. By the Act of 1854 the price was fixed at 6s. We gradually reduced that until, in 1866, it was 4s. We were before the referees in that year. The price of coal was then 16s. 7d. a ton at the works. By the 39th section of our Act we are entitled to charge 3s. 9d. for 15-candle gas to the corporation, if they should ever want it; 3s. 6d. was a price that took everybody by surprise. No one thought it was possible that a gas company could live at such a price. The other towns which have such prices, are either near the coal-fields, or there are some other special circumstances connected with them. The Act of 1866 prescribed the Birmingham burner, which affects the illuminating power of the gas considerably. Sugg's burner is now used almost everywhere with the exception of Birmingham and Brighton. If the two burners were tested, it would be found that there would be very nearly 1¾-candles of a difference in favour of the new burner. In other words, we supply 15¾-candles for 14 if we use Sugg's burner. We lose practically 1¾-candle of

illuminating power by using the old burner, which has become practically obsolete. Whatever be the result of profit or loss in connexion with the change, it is as desirable to have an accurate and proper standard burner as to have an equitable pair of scales. I have personally compared the costs of the different years to find the cost of increasing the illuminating power, and it is as nearly as possible 1d. per candle.

Mr. MICHAEL: Since 1866, have you fully carried out the provisions of your Act?

Witness: Most strictly. The directors have been extremely careful in every instance that the provisions of the Act should be complied with. Between 1866 and 1872 there has been £18,000 less paid in dividends than the maximum. During the whole of that period we have never had any complaints from the corporation of not fulfilling the provisions of our Act, nor have we had complaints from any one. We have not been able to add anything to our reserve-fund for some years. It is true that during that time we set aside a sum of about £8000 as a depreciation-fund for the purpose of making a provision towards the building of new works. I am of opinion that it would have been quite inconsistent with the working of the Gas-Works Clauses Act for us to have set aside a sum every year towards the reserve-fund. Coal and other materials have largely increased in price since 1866. During that time we have made advantageous contracts for the supply of coals and other materials, so that we have not found the full force of the rise. The average price paid by the company for coals during the seven years ending December, 1871, was 16s. 6d. per ton, or 23·28d. per 1000 cubic feet of gas. The price we are paying now is 30s. 6·22d. per ton, or 43·26d. per 1000 feet. I estimate the price for 1873 at 47·60d. per 1000 feet. The gas and meter rental realizes 44·12d., leaving an actual loss for the quarter of £3144. An increase of 1s. per 1000, and the alteration of the burner, would yield £10,828, leaving a balance of increase of £7684. To pay interest on the preference capital and 5 per cent. would take a sum of £12,390, being equal to 13·73d. per 1000 cubic feet. To pay the whole of the dividends under our Act we should require £14,750; or, to pay 5 per cent. on £125,000, we should want £9390. That would be about £2000 under 5 per cent. by the rise of one shilling. Suppose the 1¾ candle to represent 2d., that would give somewhere under £2000, and thus not quite bring up the dividends to 5 per cent. on the ordinary capital.

The CHAIRMAN: Do I understand by your statement that, if you charge 4s. 6d. instead of 3s. 6d., you could with the aid of the new burner pay 5 per cent.?

Witness: There would be a small deficiency; but, practically, it should be done in that way. We entered into a contract for 20,000 tons of coal at 21s. per ton free on board at Newcastle, which, with freight and other charges, will bring the price up to 30s. 6d. The coals are to be delivered when wanted. There is no limit as to time. That is the only contract we have at present. We have also another contract. We chartered a screw steamer for five years to carry coals at the rate of 6s. 3d. per ton. She does not carry, however, more than 650 tons, which, at the rate she is making, would be about 16,900 tons per annum, which will leave about 8684 tons to be brought in some other way at the current freight rates, which I have averaged at 8s. 3d. Taking 16,900 tons at 6s. 3d. which will amount to £5281 5s., and 8684 tons—the remainder—at 8s. 3d., amounting to £3582 3s. there will a total of £8863 freight for 25,584 tons.

Examination continued: You cannot realize large prices for coke in Brighton. There are very few manufactories there. The quantity of coke made by the two gas companies is more than the town can consume. There is no demand in Brighton for the tar and ammoniacal liquor, which we send to London at present. The difference between our price and the London price is about equal to the cost of conveyance.

Mr. MICHAEL: I believe lately there have been official inquiries with respect to the advance in the price of gas by other companies?

Witness: That is so. The Chartered Gas Company and the Neath Gas Company have obtained increased prices. The former have got an increase of 7d. per 1000 on common gas, and 10d. on cannel gas. Many other companies have availed themselves of the powers in their Act to increase their prices, in consequence of the increased cost of coal and other materials. During the seven years from 1865 to 1871 we sold about 132,000 tons of coke at an average of 8s. 9d. per chaldron. The price this year has varied very much. During the last half of 1872 it sold for 15s. 5d. It generally varies from 9s. to 20s., which I consider a very large fluctuation. The prices obtained since 1866 for gas from the outlying districts have not been remunerative. The price charged in Shoreham was the same as in the populous districts, and it is not fair that outlying districts should be supplied at the same rate as the centre of the town.

Cross-examined by Serjeant SARGOOD: Coke has been selling in Brighton lately at 26s. We sell a great deal of coke out of Brighton. When our average was 8s. 9d. it was selling in Brighton for about 16s. This average includes what was sold out of Brighton as well as in it. There was no other contract made for coals but the one I have mentioned. We have been usually in the habit of making a contract for twelve months supply, but we made this contract, as we thought, prudently, only to carry us over the winter. If the price of coal should rise still higher, we should, no doubt, be losers in consequence of not entering into a larger contract. Taken in connexion with 14-candle gas, the proper price of a candle is a penny. I had nothing whatever to do with the clause in the Act of 1866 which enacted that if the corporation should at any time ask to have the illuminating power raised one additional candle, we should charge an additional 3d. per 1000. The referees, on that occasion, decided that 15 or 16 candle gas would be the proper gas for such a town as Brighton, and they decided that 3s. 9d. was the proper price to be paid for it. Some time afterwards we agreed to admit into our bill the price of 3s. 6d. for 14-candle gas; and the difference between 3s. 6d. and 3s. 9d. is 3d., and on account of that accidental difference it has been taken for granted that the value of the candle was 3d. We would rather supply 15-candle gas at 3s. 9d. than 14-candle gas at 3s. 6d.

Serjeant SARGOOD: If you are allowed to give 14 candles under the old burner, you need only supply what is practically 12 candles now, which becomes 14 under the new burner?

Witness: That will be so. Our idea practically is this, that the cost of materials having increased, we want Parliament to give a higher price.

Serjeant SARGOOD: The price of gas going up is a sort of "rainy day" in commercial life. What have you done for the rainy day?

Witness: Nothing whatever. We have had no power, and, I may say, no prosperity since 1866. We made last year a profit of £12,000. Of course we could not, with this, meet £14,712 for dividends; the rest was made up from undivided profits taken from the reserve-fund, which was diminished by £1038. There was no depreciation-fund at the end of last year. It stood at £8000 about the commencement of the year 1871, but it has all gone. Last year we took part of it to pay for the new works. When we came to Parliament for liberty to build these works we handed in no estimate, as the capital of 1866 was sufficient to meet the cost. We asked for capital—not for the buildings, but for the ordinary increase of trade.

Serjeant SARGOOD: If you made a profit of £12,059 last year, how is it possible that it can be represented by increased cost?

Witness: Increase in the article and the manufacture of it. The total cost as against 30s. 6d. was 18s. When our bill was originally lodged in November, we asked only 6d. It is true we amended the bill in manuscript, and asked 1s. instead of 6d. and added Sugg's burner, but there has been an enormous increase in the price of coal since that time. There is competition between the two companies. The gas is the same, but the public can change if they want to do so. The new works were made with the view of our having an increased manufacture of gas.

Re-examined by Mr. RICHARDS: The shore dues are usually heavy. It is an awkward harbour, and demurrage is often incurred. At the present time it is scarcely possible to avoid it. Our maximum for gas would never have been fixed by Parliament to 3s. 6d., if the price of coal had been as high in 1866 as it is now. It is entirely on the assumption that everything has risen that the present application is made. We will require about £14,000 a year to pay a maximum dividend. The accounts are audited by the Corporation of Brighton, and the form we adopt is at their instigation. No complaint has ever been made as to the way in which the accounts have been kept. We never send away coke unless we cannot sell it in Brighton. Our object has always been to obtain the best price for it. The saving to the company by the use of Sugg's burner would be 1¾d. per 1000 feet, or from £16,000 to £17,000 a year.

Mr. *Jabez Church*, examined by Mr. MICHAEL.

I am a civil engineer, and president of the Society of Engineers. I am also ex-president of the Association of Gas Managers, and have an experience of 25 years in the construction of gas-works. I am well acquainted with the original works at Hove, and also with the present works. The removal of the works to the harbour was a boon and an advantage to the people of Brighton, as there is always a certain amount of nuisance connected with a gas manufactory. In my judgment the construction of the works is second to none in the kingdom. Everything science can suggest has been carried out in its integrity, and the working is equally good. The amount of unaccounted-for gas is extremely low, being only 10 per cent., which shows that the mains are in good order, and the distribution well conducted. I cannot put my finger upon any point of the works and say it might be improved. I have examined the estimate prepared by last witness, and concur with him in the accuracy of it. Unless the price is raised there will unquestionably be a loss to the company. If we obtain 3s. 6d. instead of 4s. 6d. for the outlying district and the small burner, there will be no probability of our paying 5 per cent. on the original capital. As regards the contract for the 20,000 tons of coal, I think it is a very prudent one. Not only has the price of coal increased, but also every other material, such as iron and firebrick, as also the value of labour, and everything else relating to the construction and conduct of gas-works. Iron has risen from 60 to 80 per cent., and fire goods 50 per cent. I think what the company ask from Parliament is fair and reasonable, and if it is not granted I believe the company will go to ruin. If we were extinct the Blackrock Company would have it all to themselves.

Cross-examined by Serjeant SARGOOD: I think the company have acted very prudently in making a contract for only 20,000 tons.

Mr. *George Wilson Stevenson*, C.E., examined by Mr. MICHAEL.

I have had many years experience in the construction and management of gas-works. I am the lessee of gas-works both in this country and on the Continent, and understand the erection of them and the cost, &c. I was the engineer of the Aldrington, Brighton, and Hove Company, which came to Parliament in 1866 to obtain powers. They obtained their bill on their promising to supply 14-candle gas at 3s. 6d. This compelled the Brighton and Hove Company to take the same price. The price in 1866 was low, but considering the then cost of coal it would have enabled the Aldrington Company to have a fair dividend—7 or 8 per cent. The company should be able to give 5 per cent. after paying the preference dividend. I agree with the calculations that have been already given. As matters stand, the company will suffer an absolute loss. If they got the shilling, after paying their preference share they may possibly, by scheming and management, pay 5 per cent. on their original stock, but they cannot do more. I know the present works well. They are well situated on the seashore, and are admirably constructed. They may be taken as model gas-works. With regard to the economy and skill with which the works are conducted, I cannot suggest anything in which they can be improved. The working is as economical as possibly can be. I consider the quantity of unaccounted-for gas to be very low. It is exactly what, in a well-managed company, it ought to be. I think the money value of a candle is about ⅝ths of a penny. The Sugg burner cannot make the gas better than it is, but it does not destroy the illuminating power.

Cross-examined by Serjeant SARGOOD: Those who have to sell at a certain rate of illuminating power can give you an inferior gas, and make it as good to the consumer by a superior burner?

Witness: Yes, if you make the burner the standard and not the gas. I think the contract for the coals is a good one. The company waited for a long time in the year, until they saw what they would require. It would not have been prudent to make a larger contract.

By the CHAIRMAN: I am prepared to say, in regard to the works, that there is no single point in which economy could be exercised to a greater extent than it is at the present time.

This concluded the evidence on behalf of the bill.

Serjeant SARGOOD then addressed the committee on behalf of the corporation. He said it was somewhat curious that the Brighton people had been taken by surprise with regard to the objects of this bill. When it was first introduced, it was an application for an increase of 6d. per 1000 feet; but when the bill came on before the committee, it was found that instead of 6d. they wanted 1s., and a change had been made in the burner which they assumed represented another 6d. The company appeared to be under the impression that they were entitled to their maximum dividend, and that it was the business of the public to get those dividends for them. Parliament, however, did not guarantee those maximum dividends. The company had entered into a commercial bargain. They had agreed to sell gas at 3s. 6d. per 1000 feet, but if materials and labour had become cheaper, no one would have thought of coming to Parliament asking a reduction in the price of the gas. It was said that 3s. 6d. was a very low rate; but when it was remembered that they had been increasing their capital, their profits, as published in the accounts, showed that they had nothing to complain of. It was perfectly clear that, apart from the exigencies of the present moment, the trade carried on by the company was a prosperous one. What, even according to their own statements, they were endeavouring to obtain, was a sort of guarantee of 5 per cent.; but there was no reason why the public should suffer because the company had not prepared to meet the altered circumstances of the day. He contended that if the company got an increase by Sugg's burner, which he held was equal to two candles, or 6d., they should not get it in money.

There was no evidence called for the corporation.

The committee decided that the maximum price be increased by 6d.; that that should apply only for one year, at the end of which time the consent of the Board of Trade was to be obtained; and that the clause providing for the introduction of Sugg's burner should be adopted.

TUESDAY, JUNE 17.

The committee proceeded to the consideration of clauses this morning. There was some discussion on clause 3, which empowers the company to charge 4s. per 1000 feet in the parishes of Brighton and Hove, "subject to any contracts subsisting at the passing of this Act between the company and any consumers." The promoters proposed to insert after the word "consumers," the words "other than the mayor, aldermen, and burgesses."

Mr. RICHARDS, in support of the proposal, explained that the insertion of the proposed words would enable the company to charge 4s. As matters stood at present, the company were bound to supply gas to the corporation at 3s. 6d. should they require it.

Serjeant SARGOOD objected to the addition to the clause, on the ground that the corporation had never received notice of such intention. The insertion of the additional words would set aside the contract between the corporation and the company, which should not expire till the end of June, 1874.

The committee decided, after some consultation, to insert the words proposed.

On clause 6, which provided for the introduction of Sugg's No. 1 Argand bur-

ner in preference to the old Birmingham burner, there arose some further discussion.

Serjeant SARGOOD asked that the old burner should still be the test as far as the contract with the corporation was concerned.

Mr. RICHARDS explained that it would be a very absurd thing to have two tests for the quality of the gas; it would be almost an impossibility.

The CHAIRMAN said that the committee intended to abide by their decision, which enacted that the Sugg burner should be used in all cases without exception.

Serjeant SARGOOD next proposed a new clause. Under the present agreement the corporation pledged themselves to burn 5 cubic feet per hour per lamp, and that each lamp was to be kept burning at the rate of 4000 hours per year, which was equal to 20,000 cubic feet per lamp per annum. This was really more than was always required, and resulted in a needless expenditure of gas. The new clause proposed to reduce the consumption per lamp to 15,000 feet without any limitation as to the number of hours each lamp was burning, or to the number of feet per hour.

Mr. *Moore*, gas analyst to the corporation, on being called, gave evidence as to the needless waste of gas in Brighton. There were too many lamps, and they were kept burning too long, only in order to fulfil the agreement with the company.

Mr. *Lockwood*, borough surveyor of Brighton, corroborated the evidence of Mr. Moore. The corporation paid the same price for their gas as other consumers. Some of the lamps were occasionally kept burning in daylight in order to consume the full quantity. 4000 hours would give an average of about 11 hours out of each 24.

Cross-examined by Mr. MICHAEL: The exact number of hours per lamp per annum is 3842. The contract is in accordance with the requirements of the Act of Parliament.

Mr. RICHARDS, in reply, said that the requirement that a certain quantity should be burnt only applied to lamps for which the corporation had the power to call upon the company to lay mains. The corporation might, for mere police purposes, choose to lay mains in a district where gas would not be required for private consumers, and the limit as to quantity was therefore a sure protection of the interests of the company.

The COMMITTEE were of opinion that the proposed clause should be inserted.

After the other unopposed clauses had been considered, the bill, as amended, was ordered to be reported to the House.

TUESDAY, JUNE 17.

THE GASLIGHT AND COKE COMPANY.

Mr. DENISON, Q.C., Serjeant SARGOOD, and Mr. GLYN were counsel on behalf of the promoters; Mr. CRIPPS appeared for the Metropolitan Board of Works; and Mr. LESLIE, a vestryman, represented the vestry of St. George's, Hanover Square.

Serjeant SARGOOD, in explaining the objects of the bill, said it contained three practical matters—first, the power to purchase ships, colliers, and lighters for the conveyance of the company's coals instead of trusting to hired vessels; secondly, the amendment of an Act of 1866 by the omission of a few words; and thirdly, the power to apply existing capital to the purposes of the Act. The company did not come to Parliament now for any addition to the capital which they already possessed. Beyond these points there was really nothing in the bill, which, however, was opposed by the Metropolitan Board of Works and by some one using the name of the vestry of St. George's, Hanover Square. The Gaslight and Coke Company, commonly known as the Chartered Gas Company, was the oldest gas company in the metropolis. It was founded as early as the year 1810, and obtained a charter of incorporation a year or two afterwards. The question of the gas supply for London had been one of a very complicated and interesting character, and had occupied the attention of Parliament more or less for some years past. In 1867 Parliament authorized an inquiry into the subject, and for two or three years committees were engaged in considering the relative claims which the companies had for consideration as to their outlay and returns, and the claims, on the other hand, of the public against them, they having a monopoly of the supply. The companies resisted the pressure of Parliament for a considerable time, and probably did not gain much by their resistance, for it ended in Mr. Cardwell's scheme being assented to, and the pressure which Mr. Cardwell put upon them was rather greater than previous committees had been inclined to put. In fact, the longer they stood out, the worse it was for them. At length the time came when it was very advisable that something should be done. The companies themselves felt it, and in 1867 Mr. Cardwell's committee made a special report on the subject. The main Gas Act was passed in 1860 for the control of metropolitan companies. It was thought at that time that a great deal had been done for the protection of the rights both of the companies and the public; however, during the course of the next six or seven years each party appeared to become discontented. At any rate the effort in 1867 was to relieve the consumers of gas as far as possible, and the amendment of the Metropolis Gas Act of 1860 became very imminent. Mr. Cardwell's committee did nothing practically in 1867 in the way of securing a bill, but they made a report in which they expressed very strong opinions, by which it was known that everybody would have to be more or less bound when they subsequently came before Parliament. In 1868 there were three parties before the committee over which Mr. Cardwell presided. In the first place the corporation of the City of London brought in a bill to enable them at their own expense to erect works and become competitors with the companies supplying the City, the Chartered, the City of London, and the Great Central. The Metropolitan Board of Works, which had previously represented the consumers, not bringing in a bill, the consumers met together and were represented by another bill for the purpose of amending the Metropolis Gas Act of 1860. The Chartered Company were also before Parliament asking for more capital, for a consolidation of all their Acts, which had become numerous and complicated, and for leave to make those beautiful works at Beckton, which are unequalled in the world for size and capability. Mr. Cardwell asked the companies whether they were prepared to accept his terms. The metropolitan companies not being before Parliament at that time, any amendment of the general Act as against them could hardly have been carried out then; but the Chartered Company put themselves to the front; they took upon themselves all the odium of accepting the pressure that was put upon them by Parliament, and they said, "We have struggled against it as long as we can; we think it is very hard upon us and somewhat oppressive; but we feel the time has come when we must bend, and we will accept your terms." Upon that Mr. Cardwell said, "If you do that the corporation need not trouble themselves about going on with their bill, for we shall not listen to them. Then came the mode by which those terms were to be carried into practical operation, and it resolved itself into this. That which was called the Metropolis Amendment Act was confined in its operation to the City of London solely. Its title was altered, and it was called the City of London Gas Act, 1868. It was practically such an amendment of the Act of 1860 as originally had been intended to apply to the whole metropolis. Then the committee said to the Chartered Company, "If we give you your bill you shall put a clause into it, that in the event of this Amendment Act becoming law, you shall not only submit to it within the City, but as you have a district extending beyond the City you shall give to so much of the metropolis as you supply the benefit of the amendment." Clause 109 of the company's Act of 1868 was as follows: "If the bill, the short title of which when passed is intended to be the City of London Gas Act, in this Act referred to as the City Gas Act, now pending, pass into law in the present session, then the company and their undertaking shall be subject to the provisions of the City Gas Act, without as well as within the City of London and the liberties thereof, and such Act shall extend to the whole of the undertaking of the company; and for the purposes of the City Gas Act in relation to the undertaking of the company beyond the limits of the City of London and the liberties thereof, the Metropolitan Board of Works shall have all the same rights, powers, and obligations as are given to or imposed upon the mayor, aldermen, and commons of the City of London in the City Gas Act as fully as if that board had been mentioned in the said Act." Thus the company were controlled by the City of London Gas Act, the authority for action being vested in the corporation, and as far as outside the City was concerned the authority for communicating with them being the Metropolitan Board of Works. The main features of the City Gas Act were these: Sections 4 to 17 contained arrangements giving the Corporation of London power to buy the undertakings of the three companies within a limited time, but that power had now lapsed. From section 18 to section 24 amalgamations were arranged which had been one of the strong points impressed upon them by Mr. Cardwell's committee, who thought it desirable to secure the amalgamations of the companies, so that there should be one source of supply, one governing body, one series of management expenses, which would tend to diminish the cost of gas and the price the consumer would need to pay for it. The amalgamations were to be carried out in this way. If the companies did not come for a bill they were to prepare a scheme which was to be laid before the Board of Trade, and if it obtained their sanction, and was confirmed by an Order of Council, it was to have the force of law. The next provisions of the amended Act fixed the dividend at 10 per cent., and a further fund, called an insurance-fund, of 1 per cent. on the capital, to provide against contingencies, and old arrangements as to reserve-fund were all swept on one side. From clause 29 to 32 a new board was invented, called the Gas Referees. They were to be an independent body, to whom certain powers were to be confided by Statute, in order to examine into and control various points with regard to illuminating power and quality. From clause 33 to 52 there were various tests for regulating the illuminating power. The old Act prescribed the amount of impurity that might exist in gas, but the new Act left that matter to the referees to settle. Sixteen-candle gas was provided for at 3s. 9d.; and then clause 57 gave that peculiar power for a revision of the price and illuminating power which gave rise recently to an inquiry before the Board of Trade, in which Mr. Reilly, Dr. Odling, and Mr. Pattison were appointed commissioners to settle the question of the rise in the price of gas. The remaining part of the Act was taken up with new forms of account and the provision of a public auditor. That was a short history of the Act of 1868, by which the company became bound, and the advantages of which they had extended to all those metropolitan consumers who formed the constituents of the various companies which had become amalgamated with the Chartered Company. In 1870, in the months of March and July, by two schemes the City of London Company and the Great Central Company became amalgamated with the Chartered Company. In the same year, by an Act of Parliament, they bought up the Victoria Docks Gas Company, a small company whose works were originally at Silvertown. In 1871 they bought up the Equitable Gas Company. In 1872 they came to Parliament for an extension of their capital, and they obtained powers to raise £1,000,000, with £25,000 borrowing power. In the month of November, the same year, by a fresh scheme, the Western Gas Company, which exclusively supplied cannel gas, was amalgamated with them, so that between the passing of the Act in 1868 and the end of last year, five other companies had become amalgamated with the Chartered Company, and all the constituents of those companies became participators in the advantages of the City of London Gas Act. The necessity and importance of economy in every possible direction were obvious when the enormous magnitude of the concern was taken into consideration, and when it was remembered that the very object of the amalgamation was to economize the cost of gas, so as ultimately to enable the public to derive a benefit from it. At the present time the company were using about 600,000 tons of coal per annum, mainly brought to London by sea. Necessarily in the winter, when the consumption of gas increased, the shipments of coal were very large, and that was the season of the year when the freights were the highest. Sometimes, too, storms delayed the arrival of vessels, and then when several came together the company had to pay demurrage on some of them. The annual payment under that head was upwards of £1000. Seven or eight steamers might well be employed to convey the coals to London. Beckton station was of very great magnitude. The company had there made, at their own expense, a private road 2¼ miles in length; and a line of railway, authorized by the Act of 1871, to facilitate the transit of coals, 1¼ mile long. A pier had been formed running out into the river, 400 feet in length, capable of discharging two vessels of 1000 tons each by means of machinery; and by arrangement with the Conservators of the Thames, who had agreed to allow them to lengthen the pier, probably facilities would be afforded for discharging four vessels without any difficulty. If the company succeeded in obtaining power to carry on the traffic in coal for themselves, a saving of 1s. per ton might fairly be expected, and 1s. per ton meant £24,000 or £25,000 a year. Why then should the consumers oppose the bill? Their lordships must remember that the Metropolitan Board of Works represented all the vestries of the metropolis, and were obliged to oppose any bill if ever so minute a vestry felt that they ought to. However, the matter was fought out in the House of Commons, and the House thought the company's application a reasonable one. The Corporation of London were as deeply interested in this matter as the Metropolitan Board could be; the company were monopolists of the supply in the City, yet the corporation did not object to the bill, and in this case at least silence must be taken to imply consent. There was only one other portion of the company's existing Act to which it was necessary to call attention—section 110, which contained these words: "Nothing in this Act contained shall exempt the company or their gas-works from the provisions of the Gas Act of 1860." This amounted to an absolute contradiction and inconsistency. The Act of 1860 had been amended and adapted, and yet here was a clause saying that the company were not to be exempted from it. This strange state of things happened thus. In the bill as originally introduced clause 110 was inserted. When the company were required to adopt the views now embodied in the bill and to apply them inside and outside the City, clause 109 was put into the bill for the purpose of accomplishing what Mr. Cardwell desired. Clause 110 ought then to have been struck out or modified, and it was a mere oversight that it remained as it was. Great inconvenience had arisen from the conflict of the two Acts in consequence of that oversight, and the company had unfortunately been involved in legal disputes with the vestry of St. George's, Hanover Square, who thought that they had caught the company tripping, and who having used the company's gas for a considerable period, politely declined to pay for it on the ground that it contained rather more sulphur than the Act of 1860 allowed. The company thought the Act of 1860 did not apply, but the Court of Queen's Bench, when they found the 110th clause perpetuating the 1860 Act, said the company could not escape from it. The company had suffered very considerably in consequence, and he was not quite sure that St. George's might not say that they had suffered too. The company successfully asked the House of Commons to make the alteration, and mainly relied on the evidence of Mr. Parkes, who had acted both for the corporation and the Board of Works. The whole point was well thrashed out before the other committee, and the Metropolitan Board did not mention it in their petition to the House of Lords, but the vestry of St. George's did. The learned counsel

then proceeded to comment on the two petitions against the bill, dealing first with that of the Metropolitan Board. The petitioners submitted that it would be most inexpedient to give the company the power to acquire and use vessels, &c., because it would divert the capital of the company to purposes never contemplated under their Act of Parliament, and any loss would ultimately fall on the gas consumers of the metropolis, who would, nevertheless, have no power to control the expenditure. If the company were asking to become shipowners, he said, for the purpose of letting out their ships to carry other persons goods, there would be some meaning in this allegation; but it was as idle to say that it was diverting their capital to carry their own coals in their own vessels as to say it was diverting their capital when they bought half a dozen waggons. All they wanted was to purchase, maintain, and use such vessels as might be required or deemed necessary or expedient for efficiently and economically carrying on their undertaking. It was perfectly idle to say such a thing would be *ultra vires*. The other petition was a most elaborate one, but contained very little that had anything to do with the subject matter of the bill. The vestry did not appear by counsel or even by their clerk, but by an individual member, and, in fact, the petition was not really the vestry's petition at all. At a meeting of the vestry on the 15th of May last, Mr. Leslie gave notice of motions, and it was usual to send by way of *agenda* to all the members ample notice of what they would be invited to discuss. When the vestry considered the notices, some gentleman was as usual found kind enough to second the motion "for the sake of promoting discussion," and the result was that on the division Mr. Leslie and his seconder were the only supporters of the motion, the remaining 33 vestrymen voting against it. Foiled in that experiment, Mr. Leslie had some communication with Lord Redesdale, and a few days afterwards got up a special meeting of the vestry, at which he used a letter he had received from Lord Redesdale, in order to try and provoke the vestry to lodge a petition against the bill, and said if they would allow him to do so he would manage the job for them, and they should not be put to any expense. On those conditions they allowed him to petition in their name. It was difficult to find out what was the object of the petition, unless it was to perpetuate the 110th clause, which their own lawsuit had shown to be inconsistent with the 109th.

Mr. *John Orwell Phillips*, examined by Mr. GLYN.

I am secretary to The Gaslight and Coke Company. It is the largest company in the world, and supplies 55,000 consumers. We manufacture two kinds of gas, cannel gas and common gas. The price at which it is to be supplied was fixed by the Act of 1868 at 3s. 9d. per 1000 feet of gas not less than 16 candles. No other metropolitan company supplies 16-candle gas. The price of the cannel gas is to be in proportion to the 3s. 9d. as 20 candles to 16, though the cannel gas we supply is 23 candles. Sugg's burner is used for testing. The cost of coal has enormously risen of late. In 1868 the average price of Newcastle coal, delivered at the retort-house, was 17s. 9½d. per ton, and cannel gas 34s. 2½d. Now the prices are 28s. or 29s., delivered in the Pool, and 47s. 6d., free on board in the Frith of Forth. By the addition of freight, dues, lighterage, &c., the cost of cannel is increased to something like £3 a ton. We have, therefore, been obliged to apply to the Board of Trade for a revision of the rate, and the Revision Commissioners decided that it was necessary to increase it for common gas for one year to 4s. 4d., and for cannel from 5s. 5d. to 6s. 3d. Unless there is a further revision we shall revert to our former prices on Jan. 1 next. The price was fixed by the commissioners after a long investigation. Both the corporation and Metropolitan Board were present watching the revision. Speaking roughly, we use something like 600,000 tons of coal a year, which is almost entirely brought by sea in ships belonging to private owners. Our largest shipments are necessarily made in the winter, but we make annual contracts. After stormy weather several ships often arrive at once; and as we have only accommodation for discharging two at the same time at our pier, we incur demurrage for the others. We can discharge two steamers of a thousand tons each in ten hours by means of machinery. We constantly employ seven or eight vessels throughout the year. If we had our own ships I think we should be able to get our coals cheaper. We have received the sanction of the Thames Conservancy Board to make an extension of our pier, which will enable us to discharge five steamers at the same time, and by that means we hope to put an end to the question of demurrage.

The CHAIRMAN: What is your calculation as to your saving per ton if you had your own steamers?

Witness: I think we should save 1s. a ton. That is the result of calculations.

Examination continued: Last year the amount paid for demurrage was £1250, but last month we incurred £150. We have 150 acres of land at Beckton, and nearly one-third is covered with the works and buildings. It is the largest works of the kind in existence. We have constructed a private road through the marshes, as there was no other means of access. There were no houses in the immediate neighbourhood, and in order to get our own workmen backwards and forwards economically and quickly, and without fatigue to themselves, it was necessary to have a line of railway through the marshes to Victoria Docks. It communicates with the North Woolwich Railway, who work the line. Our pier is 400 feet long. We propose to make it a T pier instead of an L pier as at present. No other railway touches our works. During the winter we have about 2000 men engaged at Beckton station. The great bulk of our gas is manufactured there. We also manufacture gas at Silvertown, at Bow Common, at Blackfriars, at Westminster, at Pimlico, and at Kensal Green. Blackfriars and Westminster stations are at present out of action, but the manufacture will be resumed again next winter, which I hope will be the last winter we shall have any manufacture there at all. We a have main, 11 miles long, from Beckton to Charing Cross. Generally speaking the tonnage of the vessels engaged for us is 1000 tons. One ship will make about 60 voyages in the year. The price of such a ship at the present time would be about £15,000 or £17,000. I should think the freight by steamer at the present time is about 5s. 3d. If we had our own ships I think it would be about 4s. a ton. For the five half years previous to the passing of the Act of 1868, we paid less than 10 per cent. in dividend. The next three half years we paid 10 per cent. Last half year we paid only 9 per cent., and but for the revision we should not have paid anything at all this current half year. Clause 109th of the Act of 1868 was inserted in order to extend to the parts of the metropolis without the City the regulations relating to inside the City. The 110th clause was put into the bill originally, and ought to have been struck out, being inconsistant with the 109th.

Mr. CRIPPS: Questions of economy are rather consumers questions now than questions affecting the company, are they not?

Witness: I think they affect the company and the consumers equally.

Mr. CRIPPS: You have now a parliamentary guarantee of 10 per cent?

Witness: My opinion is that the increase which we have obtained will not give us 10 per cent.

Mr. CRIPPS: You naturally think that you could conduct this collier trade satisfactorily and cheaply?

Witness: I think so. It is not a new trade to me. I have an intimate knowledge of everything that goes on in the trade.

Mr. CRIPPS: You cannot point to a single case, up to this time, where a gas company has the power you ask for?

Witness: No; but I cannot point to a single company of the same magnitude.

Mr. CRIPPS: Do you know that the Imperial, on a former occasion, thought of applying for such a power, but struck it out of their bill?

Witness: I believe that was so. At the present time we get our coal by tender, and we tender for large quantities at a time. To some extent colliery owners are ship owners also. Our principal contractors are shipowners. At Newcastle what is called the Turn Act is in force, so that a colliery proprietor has not the opportunity of serving his own ships in preference to others. The railway company are bound to see that the ships are properly served in turn. Our consumption is about two-thirds in winter as compared with one-third in summer.

Mr. CRIPPS: What are you going to do with your vessels when you only want one-third?

Witness: We are only going to employ such a number as will bring the minimum quantity of coal required.

Mr. CRIPPS: Then, under any circumstances, two-thirds of the winter coal will not be brought by your steamers?

Witness: That is so. It would not be wise to buy ships to bring the maximum.

Mr. CRIPPS: But the saving of 1s. a ton was calculated on the total quantity?

Witness: No; I did not calculate it on anything. It is a shilling a ton. Even if we save £10,000 a year it will be a handsome figure to save. The demurrage occurs more at our end than in the Tyne. At present we buy our coals delivered. We are not proposing to raise any money for the purposes of this Act. If we laid out say £50,000 in the purchase of steamers, I believe we could make them earn 20 per cent., and then 10 per cent. would go in payment of the dividend on the £50,000, and the other 10 per cent. in aid of the general dividend and in diminution of the price of gas.

Mr. CRIPPS: The consumers might gain or might lose; you might gain but cannot lose.

Witness: There is a risk. When we applied for power to raise an additional £1,000,000 it was represented that it would be required for the ordinary purposes of the gas production within the next five years, and upon that representation we were allowed to have the money.

Mr. CRIPPS: If you had told the committee last year that you were going to speculate with this £1,000,000, do you think we should not have objected to it?

Witness: I am sure you would have objected to it, but I think the committee would have granted it.

Cross-examined by Mr. LESLIE: We purchased 150 acres for the Beckton works, irrespective of the land for the road and the railway. The chief landowner of whom we purchased was the Ironmongers Company. We bought 70 or 80 acres of that company, or perhaps 100 acres, paying on an average £350 an acre. We bought under the Lands Clauses Act.

Mr. LESLIE: Did tables put before the Revision Committee show or not that the cost of the land on this swamp, with its law charges, amounted to £135,359 8s. 6d.?

The CHAIRMAN expressed the opinion of the committee that this line of cross-examination could not be permitted.

Mr. LESLIE: I am here to support the 1860 Act, and to show that the departures from that Act have led this unfortunate company into the mess in which it now is. (To witness:) Out of the charges you have made, amounting to £1,048,479 19s. 9d., at Beckton did you not appropriate £50,881 to put into the pockets of the shareholders in the shape of a dividend?

The CHAIRMAN: We cannot allow that question to be put. It is no business of ours to inquire into the general management of the company, and the auditor has passed the accounts.

Re-examined by Serjeant SARGOOD: Before the consumer can be at all interested we are entitled to get our 10 per cent., and we are only entitled to get it by due care and management. Until we get our 10 per cent., and the 1 per cent. for the insurance-fund, the consumers are not entitled to any advantage. We look upon this economy in the transport of coal as a step towards due care and management.

Mr. Serjeant SARGOOD: You are not setting up the trade of freighters for profit?

Witness: No. It is part of our business.

Serjeant SARGOOD: Just as much a part of your business to carry your coal in your own ships as in your own waggons?

Witness: Yes. If we can gain 10 per cent. now by the present means, and no more, and if we incur greater expense with our ships than we do now with the freighters, the loss would fall upon us. Until we get 10 per cent., and 1 per cent. insurance, every needless expense falls on our own shoulders.

The CHAIRMAN: Is there anything in your bill to prevent your using these ships as general traders?

Serjeant SARGOOD: If your lordship thinks the words in the bill are not sufficient, we do not object to anything being put in to that effect.

The CHAIRMAN: Do I understand that all your coal is seaborne coal?

Witness: Almost all. Only a small quantity—30,000 or 35,000 tons a year—comes by rail to Kensal Green Station.

This concluded the evidence on behalf of the bill, so far as the opposition of the Metropolitan Board of Works was concerned.

Mr. CRIPPS then addressed their lordships. He said two separate questions arose with regard to this bill. First, was it expedient, speaking generally, that gas companies should be allowed to become the owners of vessels; and next, if that were so, were there not special circumstances in this particular case which would render it undesirable to allow the Chartered Gas Company to acquire ships? This much was certain, that up to the present time no such power had been granted, and it would be *ultra vires* for any company, acting either under its charter or under its Act of Parliament, to become traders as proposed in the bill. If Parliament once went beyond ordinary legislation, and said that under exceptional circumstances power would be granted to gas companies to become traders in ships or in coal, it was quite obvious that the applications for that power would be very numerous, and the precedent being once admitted, it would be extremely difficult to know to what extent it should be applied. The occasion for the exercise of the power could not depend merely on the magnitude of the company. Companies situated at seaport towns would naturally expect to obtain the power, and others near coal-fields would claim it on the ground of exceptional circumstances. The shipping trade was a peculiar one in this country. If gas companies were to become owners of ships, it seemed very inconsistent not to permit them to become owners of collieries also. In the present case, was there any special circumstance to take it out of the general rule, or rather were there not special reasons why the ordinary rule should prevail? The company was a very large one; they could make contracts; they were excellent customers, and the payment was certain; so that anybody dealing with them would be content with a very small profit. The coal was therefore obtained as economically as possible. Nothing could be more objectionable than what the company now proposed to do. By the City of London Gas Act they had a parliamentary guarantee of 10 per cent. on their capital, and whether the shipping portion of their business failed or not, unless it could be proved affirmatively that they had not exercised due care and management, they were entitled to 10 per cent. upon all the money which they expended, and which they had the authority of Parliament to expend, and the onus of proving that due care and management had not been exercised would be thrown upon those who raised any objection. The consumers, therefore, would have to bear the whole risk of the speculation, and they did not think it prudent to incur that risk. The company got from Parliament last year the

right to raise £1,000,000 upon a 10 per cent. dividend. So long as that was only appropriated to the strict purposes for which it was granted, it might be required to be called up very slowly, and it might be a long time before it was all called up, but it was to the company's interest to call it up as soon as possible. The new shares would become more valuable in the market if it was all called up, and the persons possessing them were entitled to 10 per cent. on the whole amount. The company, therefore, had a direct interest in getting out the money as soon as possible. It was a temptation not to be economical. Parliament did not give them that £1,000,000 and the right to get 10 per cent. on it until they showed they wanted it. They told the committee that they wanted it for the purposes for which they were incorporated, and upon that evidence it was granted; but now, having got the power to raise that money, they wished to apply it for a purpose which they never gave the slightest intimation of at the time. It was one of the main vices of the bill that it did not ask for power to raise more money, because if they wanted more money Parliament would only allow them the ordinary interest of 5 per cent. Why should they be guaranteed 10 per cent. on money expended in this way as against the consumers? No doubt very sanguine ideas prevailed among the officers of the company, but they had manifestly overlooked the consideration of what the real maximum profit would be, because Serjeant Sargood had submitted, in his speech, that they would save £25,000 a year by the scheme, whereas the evidence was that it would be only £10,000, and even that estimate assumed that all the coal would be brought by sea. Nothing could be saved in demurrage, because, whether they paid a lump sum to the shipowner or an increased amount to their workmen, the result must, of course, be the same. Demurrage was no profit to the shipowner. It was simply compensation for loss which he incurred in consequence of not being allowed to unload his ship at a particular time. No trustworthy evidence had been given that any saving whatever would be effected. The committee only had the personal opinion of the secretary, and it was well known that officers were always desirous of extending their influence by enlarging their business as much as they could. When the bill was originally brought forward it was a little more consistent than it was now, for it asked for power to acquire collieries as well as ships. The word "collieries," however, had been struck out after the petition of the Metropolitan Board of Works had been lodged against it. The concession of striking out that word was really a concession of the whole question. The consumers were the parties affected, and they therefore asked not to be subjected to a risk in which they could be the only sufferers.

Mr. *Parkes*, examined by Mr. GLYN.

I was engaged in 1866-7-8 on behalf of the Corporation of London in an attempt to establish gas-works for themselves. In 1867 the matter was before Mr. Cardwell's committee, and I acted on behalf of the bill promoted by the Corporation of London, and also on behalf of the Metropolitan Board of Works. The object of the committee, as stated by Mr. Cardwell, was to apply to the parts beyond the City the provisions relating to the City, so that the Act of 1865 might in all its force be applicable outside as well as in the City. I stated that I could frame a clause to that effect, and I wrote out the 109th clause. The 110th stood part of the original bill. I did not trouble about any of the clauses except the 109th. If I had attended to the other clauses I should have struck out the 110th, for the two clauses are practically alternative clauses.

Cross-examined by Mr. LESLIE: I have no recollection of Mr. O'Malley drawing the 109th clause.

Mr. *Wyatt*, examined by Serjeant SARGOOD.

I was parliamentary agent for the companies in 1868. I remember the 109th clause being inserted for the purpose of applying the provisions of the Act to parts outside the City. It was prepared by Mr. Parkes. The 110th section escaped my attention after the passing of the 109th.

Mr. LESLIE addressed their lordships on behalf of the vestry of St. George's, Hanover Square. He contended that the companies had vastly benefited by the Act of 1860, and that it was inexpedient to omit the 110th clause.

The room was cleared, and the committee consulted for a short time, when the counsel alone were called in; and, on the readmission of the public, it was announced that the inquiry stood adjourned till the following morning. It was, however, understood that the committee had agreed to the preamble, intending to limit the dividends on the money invested in the shipping business.

WEDNESDAY, JUNE 18.

The committee this morning proceeded to consider the clauses of the bill.

Mr. CRIPPS proposed to limit the capital to be expended on the new branch of the business to £100,000, but, after some discussion, the committee fixed the sum at £150,000.

The following clause was inserted: "The company shall not, out of the profits of any half year in which they are entitled by the sanction of the Board of Trade to charge any higher price for gas than the charge authorized by their Act of 1868, pay a larger dividend on the capital so expended than at the rate of 7 per cent. per annum."

These were the chief alterations and amendments, and the bill was then ordered to be reported to the House.

Miscellaneous News.

DUNDEE GAS COMMISSION.

The Annual Meeting of the Commission was held in the Town-Hall on Wednesday, June 18—Baillie MAXWELL presiding.

The accounts for the year ending the 30th of April, of which the following is an abstract, were presented.

Capital Account.—To amount expended at April 30, 1872, £49,469 6s. 8d. To amount expended at April 30, 1873—Dundee Gas Amendment Act, 1872, £632 4s. 11d; main-pipes, £423 1s.; service-pipes, £307 17s. 7d.; new meters, £1822 6s. 11d; new coal stores, £229 18s. 8d.; Invergowrie extension, £731 9s. 5d.; Downfield extension, £398 2s.; new apparatus, £5 11s. 2d.; carried to general balance-sheet, £15,750 1s. 8d.; total, £69,770. By loans on mortgage, £69,770.

Revenue Account.—To coal account, including firemen's wages, £29,305 15s.; purifying account, £1231 7s. 10d.; main pipe repairs, £116 4d. 2d.; service-pipe repairs, £216 4s. 7d.; meter repairs, including inspectors and fitters wages, £533 17s.; retorts and setting, £926 0s. 1d.; gas apparatus, tools, &c., £305 3s. 8d.; repairs of buildings, £338 18s. 4d.; refuse account, £262 1s. 10d.; rents, feu duties, &c.—less rents received, £372 16s. 7d.; interest on mortgages, £2127 3s. 4d.; expense of loans, £78 8s. 7d.; interest on bank account, £286 10s. 10d.; assessments, taxes, &c., £1624 10s. 1d.; salaries, including collection of revenue, £1968 12s. 1d.; stationery, printing, &c., £168 5s. 11d.; general expenses, £195 4s. 10d.; public lighting, £80 1s. 3d.; annuities, £8662 10d.; redemption of annuities and mortgages (sinking-fund), £1000; contingent-fund, £500; total, £50,299 16s. By balance from April 30, 1872, £2710 13s. 4d.; gaslight account, £40,298 19s. 2d.; meter-rents, £2058 16s. 11d.; coke, £1633 7s. 1d.; chemical products, £2959 16s. 1d.; deficiency carried to general balance-sheet, £638 3s. 5d.; total, £50,299 16s.

The clerk read an estimate of the income and expenditure for the year from the 1st of May last to April 30, 1874, which showed the total estimated income at £67,897 7s. 4d., and the outlay at £67,822 12s. 5d.

Mr. P. M. DUNCAN, Convener of Finance Committee, expressed his regret that he could not lay before the commissioners a more favourable statement than they had heard, but looking at everything it was on the whole very satisfactory. They had estimated the surplus at the end of last year at £373 12s. 5d., but there was a deficiency of £638 3s. 5d. The estimated revenue was £47,733 19s., and the actual sum obtained was £49,661 12s. 7d., being an increase of £1927 13s. 7d. The estimated expenditure was £47,355 1s. 7d., and the actual outlay £50,295 16s. 1d., being £2944 9s. 6d. above the estimate. The heavy portion of this arose on the coal account, namely, £2124 3s. 2d. In the estimate the price of coal was taken at 24s. 11d. per ton, whereas the actual cost was 25s. 11½d., or an excess of 1s. 0½d. per ton, which, upon 22,587 tons, gave a sum of £1176 8s. 1d., and the difference was caused by the increased quantity of gas made. This increase in the cost per ton arose by the commission being under the necessity of purchasing coals during the year at enhanced prices, in consequence of the difficulty in getting delivery of the coals contracted for. However, the commissioners would be no losers by that, as they had about 3580 tons on hand and to deliver of the old contract, the difference in value upon which between the present market value and the contract prices would amount to £2430 in favour of the commission. They had also placed £1000 to the sinking-fund and £500 to the contingent-fund—the latter sum not being included in the estimate. The other items making up the increased cost arose from the advance in wages, &c., over which the commissioners had no control. The commissioners estimated the quantity to be made during the year at 240 million feet, while the quantity delivered had been 252,300,000 feet, being an excess of 12,300,000, or an increase of 5 per cent. The quantity sold the first year they had the gas-works was 201 million feet, and they now sold 252 million feet, or an increase of 51 million. In consequence of the increased price of coal, and in the carrying on of the works, he had to move that for the year ending April 30, the charge for public lamps should be 5s. 7½d., being an increase of 1s. 8½d.; for ordinary consumers supplied in Dundee, 6s., less 5 per cent.; for Invergowrie, 7s. 9d., less 5 per cent.; and for Downfield, 8s. 6d,, less 5 per cent.—being an increase on each of 1s. 9d. The commissioners estimated the quantity of gas to be sold at 265 million feet, being an increase of 12,700,000, or 5½ per cent.; they estimated the revenue at £67,897 7s. 4d., and the expenditure at £67,822 12s. 5d., leaving a surplus of £74 14s. 11d. He accounted for the increase in price as follows:—Surplus at April 30, 1872, £2710 13s. 4d.; deficiency at April 30, 1873, £638 3s. 5d.—leaving £3348 18s. 9d. This belonged to last year, and represents 4d. per 1000 feet. The cost of coal this year was £1 17s. 9d. per ton, and last year £1 5s. 11d.—showing a rise of 11s. 10d. per ton. On 24,091 tons at 11s. 10d., this gave £14,253 16s. 10d.; the additional interest this year caused by the new works was £786 5s. 10d.—making a total of £18,388 19s. 5d. One penny per 1000 cubic feet of gas on the total quantity sold amounted to about £890, so that the sum of £18,388 would account for a rise of 1s. 8½d. per 1000 feet. The bad debts last year were £153 19s. 3d., being only 7s. 4d. per £100, while the first year they were 16s. 10½d. per cent. When the commission acquired the gas-works the selling price was 5s. 4d. per 1000 feet, or only 4½d. less than what he now proposed to be charged, and considering that at that time coals were considerably under half price, and wages, &c., very much under what they were now, they did not have very much cause of complaint. He was informed the price of gas in Perth was 7s. 6d., and in Edinburgh and Leath since November, 5s. 8d. He concluded by moving the approval of the estimates.

Mr. WEBSTER seconded Mr. Duncan's motion.

The CHAIRMAN remarked that there was no other course open to them than that proposed by Mr. Duncan, and he thought they might congratulate themselves that the increase was no more than that stated.

The estimates were unanimously approved of.

Mr. MOIR, convener of the Works Committee, explained what was being done at the works. During the past winter the scarcity of coal had caused great anxiety and expense to the commission. There had been considerable progress made throughout the year in the lifting of idle main-pipes and the removal of worn-out service-pipes, and this work was being continued wherever it could conveniently and with propriety be done. The new works connected with the improvement and extension of the plant in the gas-works were progressing in a satisfactory manner, and nothing had yet occurred to diminish the hope of having the new apparatus ready for use in the course of the season, as contemplated. The stability of the works generally had been fully maintained, and in many respects improved, during the year. Notwithstanding the large increase in the price of the gas, it was still so far satisfactory to know that the rate was only about 4½d. per 1000 feet higher than when the works were acquired by the commissioners, while the coal had now more than doubled in price, and wages and material generally had increased from 20 to 30 per cent. The work was being carried on in the most energetic and economic manner possible.

The CHAIRMAN bore testimony to the great service rendered to the public by Mr. Moir, Mr. Duncan, and Mr. Macrae, the manager of the works; Mr. Matthew, the treasurer; and Mr. Thornton, their able clerk.

EDINBURGH WATER SUPPLY.—At the meeting of the Water Trust on the 12th inst., the superintendent of works, Mr. Coyne, submitted the following as his monthly report:—"The number of men variously employed in the works department in town and county during the month of May was, on an average, about 90, 60 of whom had been occupied in the different branches of town work, and 30 in the county. There was 508 pipes laid during the month, 294 in Edinburgh, and 214 in Leith. The part of the town under inspection for the checking of waste comprehended a large area of the city—viz., from Lauriston Park and the Cattle Market in Spittal Street and Downie Place, thence by the canal and southward, embracing Merchiston and Morningside, and eastward by Powburn to Causewayside and Melville Terrace, including all the Grange and Greenhill. The number of apparatus examined was 21,645, of which 21,004 were found good, and 641 faulty. The waste of water found in 140 houses, occupied by 817 persons amounted to 42 gallons per minute. The number of houses in the district is 4767, of which 211 were found unoccupied or shut, and 4556 occupied by a population of 22,295 persons. The total number of apparatus examined from the 1st of January 1872 to 31st ult. was 263,705, of which 249,059 were found good and 14,646 faulty and ordered to be repaired. There were an average quantity of 889·29 cubic feet of water per minute brought into the city during the month, which is equal to 8,003,610 gallons per day, and which, to a population of 265,000, is equal to 30·19 gallons per head per day. The maximum supply to Edinburgh was 32·36 gallons per head per day to a population of 212,400; the minimum, 23·78; the average, 30·43. The maximum supply to Leith was 30·85; the minimum, 29·31; the average, 29·93 gallons per head per day to a population of 47,000. The maximum to Portobello was 27·85; the minimum, 25·17; the average 26·40 gallons per head per day to a population of 5600. The average delivery of water in the month of May last year was 958·63 cubic feet per minute, as compared with 889·29 cubic feet per minute last month, the difference being 622·203 gallons per day, which may be safely assumed as the minimum effect of the inspection for checking waste, and notwitstanding this reduction the supply was better last month than it was in May, 1872. I beg to inform the board that, for the first time in the history of the water supply of Edinburgh, water has reached by gravitation the first storey in Nelson's Monument on the Carlton Hill, a height of 362 feet 9 inches above Ordnance datum, and 124 feet 9 inches above the Regent Road. This is entirely due to the repairs of faulty apparatus, which was previously unable to resist the night pressure. A cistern in Nelson's Monument, the capacity of which is 250 gallons, is now filled in the space of 40 minutes, affording an ample supply of water to the keeper and his family, and a refreshing drink of cool Crawley to the visitors."

BOMBAY GAS COMPANY, LIMITED.

The Ordinary Meeting of this Company was held at the City Terminus Hotel, Cannon Street, London, on Thursday, June 26.—DANIEL THOMAS EVANS, Esq., in the chair.

The SECRETARY (Mr. W. Marshall) having read the notice convening the meeting, and the minutes of the last meeting, the corporate seal was affixed to the register of shareholders.

The following report, with statements of accounts annexed, was then presented:—

Your directors have pleasure in meeting the shareholders and presenting a statement of accounts for the half year ending the 31st of December last, duly audited.

The progress of the company during this interval, though not rapid, has been steady and satisfactory. In the use of gas by private consumers there has been a fair increase; and the residual products, coke and tar, have had larger sale, at enhanced prices. There has been considerable profit yielded this half year by fittings.

The net profit for the half year is £11,596 1s. 7d.

Your directors have added to the reserve-fund £2000 for the half year, making a total of £3597 thus appropriated in the year; and they have written off from the reserve-fund for depreciation £775 2s. 5d. in the half year, making a total of £1934 14s. 4d. in the year, and leaving £5796 16s. 3d. at the credit of the reserve-fund.

The general revenue account, after payment of the interim dividend of 3½ per cent., and interest on debentures, on the 1st of January last, shows a balance of £9657 10s. Out of this your directors recommend the shareholders to declare a dividend of 3½ per cent., making 7 per cent. for the year, free of income-tax, and payable on the 1st of July next. This will absorb £9000 and leave £657 10s. to be carried forward to next half year.

Your directors regret the retirement of Mr. Charles Frederick Collier from the board, but there still remaining a sufficient number of directors to perform efficiently the business of the company, your directors recommend that the vacancy be not filled up.

The directors who retire by rotation are Daniel Thomas Evans and William Fletcher Gordon, who being eligible offer themselves for re-election.

General Balance-Sheet, Dec. 31, 1872.

Dr.				*Cr.*			
To Capital authorized:— (50,000 shares, at £5 each—£250,000.)				By Construction			£198,401 5 9
40,000 shares, £5 paid	£200,000 0 0			Goods *in transitu*			3 9 3
10,000 „ £4 paid	40,000 0 0			Services account			192 17 10
		£240,000 0 0		Retort account			362 10 7
Debentures		19,750 0 0		Stock in trade, viz.:—			
Amount owing by the company		1,511 17 10		Chandeliers, brackets, &c.		7,915 16 8	
Dividend		7,800 0 0		Brass and iron goods, tubing, &c.		9,328 4 9	
Reserve-fund	4,501 18 8			Materials, mains, and services		2,233 16 7	
Added this half year	2,000 0 0			Meters		5,436 11 7	
	6,501 18 8			Coal		17,405 1 0	
Written off brass and iron goods, meters, tools, services, &c.	775 2 5			Coke		1,461 5 9	
		5,726 16 3		Tar		1,183 12 8	
Insurance-fund		377 11 2		Oxide, tools, fire materials, &c.		1,654 18 3	
Balance to general revenue account		9,657 10 0				6,512 7 5	
				Amount owing to the company			
				Cash at bankers, on deposit, and in hand	£26,531 17 2		
				Bankers bills in hand	6,000 0 0		
						32,531 17 2	
		£284,823 15 3				£284,823 15 3	

Profit and Loss Account, for the Half Year ending Dec. 31, 1872.

Dr.		*Cr.*	
To Coal carbonized	£7,224 8 2	By Gas and meter rental	£19,602 0 6
Wages	1,386 19 3	Coke	3,409 6 1
Purifying	37 8 8	Tar	624 7 9
Maintenance of retorts	112 10 1	Fittings	966 14 4
Trade and general charges	1,232 4 3	Exchange and interest	50 19 7
Salaries and collectors commission	1,823 12 1	Transfer fees	16 11 6
Rents, rates, and taxes	586 12 0		
Law expenses	31 15 2		
Directors and auditors remuneration	601 5 0		
Bad debts and allowances	47 3 6		
Net profit	11,596 1 7		
	£24,669 19 9		£24,669 19 9

General Revenue Account, Dec. 31, 1872.

Dr.		*Cr.*	
To Dividend for the half year ending the 30th of June last	£7,800 0 0	By Balance the 30th of June last	£8,453 18 5
Interest on debentures	592 10 0	Net profit for the half year ending Dec. 31, 1872	11,596 1 7
Amount carried to reserve-fund	2,000 0 0		£20,050 0 0
Balance carried down	9,657 10 0		
	£20,050 0 0	Jan. 1, 1873.—Balance brought down	£9,657 10 0

The CHAIRMAN: Gentlemen, the report and statement of accounts which have been circulated amongst you, and are now in your hands, will, I think, give some assurance to you that the business of the company has progressed satisfactorily, and that the advance which has been made has been a sound and substantial, though perhaps not a very rapid advance. We here, in this country, have of late seen coal rise in price to double and even treble its former cost, and the necessity has been imposed upon gas companies at home, and I may say abroad, generally throughout Europe, of increasing the price of gas. But during the period now under review the Bombay Gas Company have regularly supplied gas of the standard illuminating quality without making an advance in price to their constituents in Bombay. I know not how they regard it, but I think they ought to regard it with thankfulness, seeing what has taken place necessarily all over Europe. It has been my custom at these annual meetings to contrast the working of the last six months of the past year with the corresponding period of the previous year; and I propose to do so on this occasion, because I shall thus give you a very clear idea of the advance we have made, and how we stand at the present moment. Our coal, which is the material item in the affairs of the company, has cost us during the six months ending Dec. 31, 1872, £2 0s. 11d. per ton, or £7224 8s. 2d., which is nearly the same as last year. The make of gas per ton of coal during the half year was 9549 cubic feet. I have observed on more than one occasion that our English coal contains a large quantity of iron pyrites, and we have, therefore, sometimes had it heat, which to a certain extent has diminished the yield of gas. Still this is upon the whole a good average yield. The sale of gas per ton was 8869 cubic feet. You will remember that our leakage for three or four years was exceptionally high, and this time twelve months ago it figured at a large amount, because we were then relaying and extending our mains. It is now, I am happy to say, reduced to 7·60 per cent. The total quantity of gas made in the half year was 33,676,000 cubic feet, as contrasted with 32,920,000 during the corresponding six months of last year, showing an increase of 756,000 cubic feet. The gas sold was, in the half year, 31,291,000 cubic feet as contrasted with 30,523,800 cubic feet, the quantity sold in the corresponding period of 1871 being an increase of 767,300 cubic feet. With reference to the stock of coal which is a very vital matter with us, I may remark that on the 31st of December last our stock was 8551 tons, or about 15 months supply. Since then we have chartered ships, carrying nearly 5000 tons from Australia to Bombay, sufficient—if those ships arrive—for our requirement until the end of 1874, at a cost, as nearly as we can calculate, of about 9s. per ton on the average over that already in stock. Now you must bear in mind that the value of our coke corresponds to the price we pay for our coal, and though we shall have to pay 9s. per ton more for the latter, the price we shall realize by our coke will to a considerable extent compensate us for this additional outlay. In 1872 our coke yielded £3409 as contrasted with £2459 in 1871, showing an increase of £950, which I think you will say is very satisfactory. We are doing extremely well in this matter of coke. We have had heavy contracts with the Bombay and Baroda Railway at 50s. per ton, and we are selling to small consumers—lime burners and others—who I am happy to say are on the increase, at from £2 16s. to £3 per ton, a price which, considering that we get coals at £2 0s. 11d. per ton, we cannot consider a bad one. In the very last letter of our manager (written in the ordinary course of business, and without a view to quotation here) dated the 30th of May, he says: "Our sales of coke still continue most satisfactory. The whole of the coke produced is cleared off the ground at once. The small stoves will tend to increase the demand, and for cooking purposes we can always get a good price, and give them the small coke. I hope to sell the whole of the stoves now in hand in a few days. Perhaps I might get rid of them quicker if I advertised them, but the expense is too great. I am keeping the fuel account as low as possible." The next thing I come to speak upon is the question of "fittings." In the year 1871 our returns for fittings were not merely "nil," but there was a trifling loss upon them. In 1872, however, there was a profit of £966, which again I think is very satisfactory. And now I have to touch upon a matter which has been very unfortunate for us in times past, that is the "exchanges," which have been steadily adverse to us for eighteen months. We have very large sums of money now in Bombay, and we have on this side, including the money we shall have to dispose of in the payment of interest and debentures, £18,000 in our strong box. We have about £22,000 in Bombay upon deposit account, because we cannot utilize it, as to bring it over here would be to our considerable loss on exchange. You will remember that some time ago the Municipality were eight or ten months in arrear, and that we had two bills of theirs dishonoured. At that time freights were low, and we laid out about £26,000 in the purchase of coals, which money we obtained chiefly on debentures. We are now able to pay that off, and though I am of opinion that we should not be justified in buying up our debentures at a premium, I may say that if there is any gentleman present who has debentures which he is willing to dispose of we can pay them off at par, and shall be happy to do so. I think we had 3 premium for them when first issued. But now, with reference to exchange and interest, it will be observed that there is a profit in the six months of £51. This is owing to the interest received on our deposits exceeding the amount which we lost by adverse exchanges. In previous accounts the interest on debentures appeared on the debit side of the profit and loss account, under the heading "Exchange and interest;" but this half year we have thought it best (as making it more explicit) to state it in the "General Revenue Account." I am happy to inform you that the condition of the works is good, and I have in my hands a report which we have received from our able resident engineer and manager, Mr. Scott, assuring us of that fact. If you will now refer to the accounts, I propose briefly to go through them and make an analysis, taking out the most prominent items. The construction account on Dec. 31, 1871, showed a sum of £198,133; on December 31, 1872, that amount had been increased £268, which sum had been expended during the year, principally on account of laying new mains and services. Under the head of "Stock in trade" you will see that the stock of chandeliers was decreased last year to the extent of £488, but against this there is money on the other side. Brass and iron goods, tubing, &c., decreased £1339; materials, mains, and services, £272. Meters, £587, and coal, £9464; whereas coke shows an increase of £1444. Tar decreased £156; oxide tools, fire materials, £53, and retort account, £88. Nearly all of these items are in our favour. The cash at bankers on deposit and in hand on the 31st of December, 1871, was £9366, while on the 31st of December last it amounted to £32,531, being an increase of £23,165. Of course we have been steadily turning our coal into gold, and that accounts for the large sum of money we have in Bombay and in England. The amount owing to the company on Dec. 31, 1871, was £11,390, while on Dec. 31 last it was only £6512, being a decrease of £4878. The amount owing by the company on Dec. 31, 1871, was £10,881; at the end of last year it was only £1511, being a decrease of £9370. Our debentures on Dec. 31, 1871, were £5000, now they are £19,750, showing an increase of £14,750. This you know arises from the fact, as I stated before, that the Municipality were in arrear with their payments to us, and that we were under the necessity to provide a large stock of coals, so as to take advantage of cheap freights. The reserve-fund shows an increase of £1662 in the year, and the insurance-fund a decrease of £16. The balance carried to general revenue account is £9657 10s., which is £224 less than last year. If you will now refer to the "Profit and Loss Account," you will see that the gas-rental has decreased £95. In the half year ending December, 1872, the rental was £19,602, as contrasted with £19,697 in the corresponding half of 1871. This is due to the fact that the reduction of price—1s. per 1000 cubic feet—was in operation during the whole of the last six months of 1872, whereas in the corresponding period of 1871 it was only in operation during four months. The actual increase in the private lighting during the last six months was 541,000 cubic feet. Coke shows an increase of £950 in our favour; tar of £42; fittings, £966; transfer fees, £2; exchange and interest, £51; making a total increase of £2011. On the disbursement side you will see that our coal last half year cost £7224, as against £6990 in 1871, being an increase of £234. We

produced more gas and we burnt more coal. Wages last half year were £1386, as contrasted with £1367, being an increase of £19. There was a decrease in the cost of purifying of £10, in maintenance of retorts, £18; and trade and general charges, £148. In salaries and collectors commissions there is an increase of £38, and in rents, rates, and taxes of £180. This latter increase is due to the income-tax, but I am happy to say that now the income-tax in India is abolished, and instead of paying income-tax in India and in England, we shall only have to pay it here in future. Our law expenses last half year decreased £22; directors and auditors fees remained the same, and bad debts increased £36. Considering that we have a gas and meter rental and returns for coke and tar sold of upwards of £40,000 a year, our loss by bad debts is a very trifling matter. On exchange and interest our expenses were diminished last half year as contrasted with the corresponding period of 1871 by the sum of £307. The result of this comparison is to show that the net profit of the company for the last half year was £11,597 as against £9683 in 1871. This is the highest amount of net profit that has ever been realized in one half year since the commencement of the company. I think this statement will not be considered unsatisfactory by you. With regard to the past, we have done reasonably well. As regards the present, we are doing well; we are on the best of terms with the Municipality, with whom, as you know, we had more or less of difficulty in times gone by. We are supplying an excellent gas at a reasonable price, and, as I said before, the community of Bombay ought to consider themselves highly favoured that there has been no increase in the charge to them—an increase having been made in most other parts of the world. As regards the future, we may regard it hopefully. I will just read you a line or two from the last letter of our able and energetic manager, Mr. Walter Scott. He says: "I have made great reductions in the staff without the slightest detriment to the good working of the company. We have some rather extensive orders in hand for fittings. Amongst others, the Native General Hospital, the corporation market, the new theatre, the new museum, and several large bungalows at Malabar Hill." With these remarks I conclude. I now move—"That the report and statements of account circulated among the shareholders be received and adopted, and that a dividend for the half year ending the 31st of December last, of 3¾ per cent., free of income-tax, be now declared payable on and after the 1st of July next."

Major SUART seconded the motion.

Mr. SEWELL said he thought he was in duty bound to rise and express his satisfaction with the statements made on this occasion with reference to the fittings. He was afraid that his name would be regarded in the past as that of a malcontent in respect to that subject; however, he was very pleased now to observe that the fittings had yielded a fair and substantial profit. The chairman had spoken of the sale of stoves by the company, and it occurred to him, when the statement was made, that the company were going somewhat out of their way to deal in articles of the kind. He did not know of a company, either English or foreign, which had adopted a similar course. Perhaps Mr. Stephenson could tell him whether there was a precedent for it in the Singapore Company. Remembering how unsatisfactory had been the result of dealing in fittings in past times, he doubted whether it was good policy on the part of the directors to begin the sale of stoves, and would rather urge upon them to confine themselves to the sale of gas and the products arising from its manufacture. It was his pleasing duty to congratulate the directors on their success in the past half year, and he was sure no proprietor present would be backward in giving them their meed of praise. With regard to the purchase of coal, he thought it was rather a serious thing that the directors had entered into arrangements for so long a period as the end of 1874, at an advanced price of 9s. per ton. It was true the chairman had explained the compensating advantage in the value of coke, but he doubted whether it was well for them to bind themselves with contracts for coal for so long a period in advance. And in reference to the price of gas, he would ask whether with coal at 9s. per ton additional price it was right to continue to sell gas at the same price. As to the relations of the company to the Municipality, it would be very satisfactory to the shareholders to hear something from the chairman as to how matters really stood.

The CHAIRMAN said at the inception of the company the directors had to study how best they could promote the consumption of gas, and they believed that in Bombay, where the price of charcoal and other articles for cooking was very high, they might reasonably expect a considerable revenue from the supply of gas for cooking purposes. They therefore introduced cooking-stoves, which, however, were not so well taken up then, not being understood, as they were now. The amount expended originally in this direction was not large—probably not more than £200—and latterly another £50 had been similarly expended. As to the purchase of coal, the hon. proprietor must remember that the directors were obliged to look forward to the future. Coal might be cheaper, or it might be dearer; but, in any case, he thought they were doing well in chartering ships upon the terms they had done. It must be borne in mind that they were legislating for the future. They were chartering ships to "go the round", and, after all, as had been frequently stated by Major Suart, it was not with this company so much the price of coal as the cost of freight which pressed them most severely. With regard to the Municipality, all the past difficulties between them and the company had been adjusted, and their present relations were entirely satisfactory. The two dishonoured bills for £10,000 had been paid, with interest.

Major SUART: The great misfortune is that they do not owe us something.

Mr. H. P. STEPHENSON, replying to the inquiry put to him as chairman of the Singapore Gas Company, said not only did that company carry on business in the sale of gas-stoves, but he scarcely knew a company at home or abroad that did not do it. Several companies with which he was connected in England not only sold them, but fitted them up at a rental for their consumers, and derived a considerable revenue from their hire, besides promoting the consumption of gas. He should not advise this company to let stoves on hire at Bombay under the circumstances of that place, but it would be suicidal to give up the sale of them, especially as the capital involved in that department of the business was so trifling. The honourable proprietor had expressed an opinion that it was not wise to continue to sell gas at the same price while paying an increased price for coal. The position of the company, however, was this, they had enough coal in stock to last till March, 1874, at the old price, but the directors were now, cautiously and in moderate quantities, laying in coal to last from that time until the end of 1874. If they did not do that they might find themselves without coal some months hence, which would be a very serious state of things. The coal they were now buying at an increased cost of 9s. would be laid in between March and December, 1874; but then the 9s. spread over the 18 months would not make the cost of the whole quantity used more than 2s. or 2s. 6d. higher on the average, whereas they were getting 18s. per ton increase in the price of coke. As to the suggestion to raise the price of gas in consequence of the advance in the cost of coal, he thought himself, and he believed the directors generally concurred, that the price of gas at Bombay was quite as high as it ought to be, and that any increase of price would necessarily tend to decrease consumption, and consequently profits. If any alterations were made, his own mind would rather incline to a reduction.

The CHAIRMAN said that was the opinion of the whole of the board.

Mr. SEWELL: What is the price of gas now?

Mr. STEPHENSON: 14s.—nominally; but with discounts for prompt payment it is reduced to 13s. per 1000 cubic feet.

The CHAIRMAN: The effect of giving discounts for the prompt payment is that our bad debts are so small. The practice in Bombay is to pay monthly.

The motion was then put and carried.

Major SUART: It is now my pleasing duty to submit to your notice the re-election of our chairman, and I am sure, after the able manner in which he has presided at this meeting, and the zeal and energy he has always shown in the conduct of the business of the company, always urging us forward, you will unanimously and heartily concur in re-electing him to a seat at the board.

Colonel ROBINSON seconded the motion, which was carried unanimously.

The CHAIRMAN: Gentlemen, I am very much gratified by the cordial manner in which you have received the proposal of my friend, Major Suart, and I am greatly indebted to him for the very kind way in which he has spoken of me, and my services to the company. I thank you all for my re-election. I shall continue to do my best, as I presume to say I have done hitherto, for the interests of the company. I have now much pleasure in moving the re-election of Major Gordon. He has been upon the board from almost the earliest times, he is a man of excellent judgment and discretion, and he is always punctual in the discharge of his duty.

Mr. LYSLEY seconded the motion, which was put, and carried unanimously.

Major GORDON acknowledged the compliment.

On the motion of Mr. SEWELL, seconded by Mr. LINGING, the retiring auditors were re-elected, and Mr. R. King returned thanks for himself and Mr. Bradley.

Major SUART: The Chairman has allowed me to propose a resolution, which I have great pleasure in doing, and which I believe you will unanimously agree to. It is a vote of thanks to our Manager and Officers in Bombay for the able manner in which they have conducted the business of the company during the past year. I am sure that the whole of the directors are much pleased with the way in which the duties devolving upon those officers have been discharged, and will join in this expression of thanks for their services.

Mr. LINGING seconded the motion.

Major GORDON: I think a great deal of the succes of our company is due to our worthy Secretary, and therefore I suggest that we should couple his name with the Engineer in this vote.

The CHAIRMAN: I entirely concur in every word that Major Suart has said, and with reference to our secretary I am sure we shall all feel gratified in giving him a vote of thanks. He is always at his post, and most zealous and indefatigable in the performance of his duty.

The resolution was cordially adopted.

The SECRETARY: Gentlemen, on behalf of the engineer and manager, and on behalf of the other officers of the company, as well as for myself, I beg to return you thanks for the resolution just passed in our favour. By to-morrow's mail I shall convey to the officers in Bombay the gratifying intelligence of your approval, which doubtless will act as an incentive to renewed exertions on their part to retain your confidence, and, if possible, to increase your dividends.

Colonel ROBINSON moved a vote of thanks to the Chairman and Directors, and expressed the gratification with which at all times he witnessed the unanimity prevaling at the board.

Mr. LINGING seconded the motion, which was put and carried.

The CHAIRMAN acknowleged the vote, and the proceedings terminated.

BURSLEM AND TUNSTALL GAS COMPANY.—The annual meeting of the shareholders was held on the 6th ult., in the company's offices at Longport. Mr. A. Shaw presided. The following report of the directors was read and adopted:—"It is with much satisfaction that the directors present to the shareholders the accompanying statement of accounts, which, while exhibiting the very serious consequences of the great advance in the price of coal, give evidence of strong vitality in the undertaking. Of the item for residuals, however, it has to be admitted that a large proportion is due to the circumstance of large stocks of coke and tar on hand on the 31st of March, 1872, having been disposed of during the last twelve months. On the other hand, £450 has been written off this year's profits to meet discounts allowable on current quarter's accounts; and as this item balances the receipts from stocks, the balance of £3398 4s. 2d. shown in the statement may be accepted as the actual profit on this year's business. The directors recommend the payment of the usual dividends (free of income-tax) after payment of which there will remain a balance of £563 4s. 2d. to carry to the reserve-fund. It is quite clear, however, that with the greatest economy possible a very large sum will have to be taken from this fund, to meet dividends next year, unless there be a speedy reduction in the price of coal. The directors have pleasure in reporting that the plant is in good and efficient condition. Two directors—Mr. Daniel Ball and Mr. Joseph Edge—and one auditor—Mr. John Gater—retire by rotation, and offer themselves for re-election." The report was adopted, and the customary maximum dividends were declared. The retiring directors and auditor were re-elected, and the meeting closed with votes of thanks to the directors and manager (Mr. Woodall), the latter receiving very marked compliments from shareholders and directors.

RIO DE JANEIRO GAS COMPANY, LIMITED.—An extraordinary meeting of the shareholders was held at the London Tavern, on the 20th ult., Mr. Howard in the chair. The chairman said, in accordance with previous resolutions, the directors applied to the Brazilian Government some time ago for liberty to increase the capital by a sum of £150,000, and that concession had been granted. There was a balance of £127,000, which had been taken year by year from the surplus profits and set aside to insurance and contingency fund, of which a great part was already expended, and the board were daily incurring further expenditure on that account in extension of the company's mains and works, all of which brought increased revenue to the company. They were therefore now in a position to issue bonus shares to the extent of £120,000, which would leave £7006 18s. still to the credit of the insurance and contingency fund. The shares would be issued to the shareholders as bonus shares, without any payment whatever. He then moved the following resolutions, which were unanimously adopted:—

1. That the capital of the company be, and the same is hereby increased by the addition of £150,000, divided into 7500 shares of £20 each; and that the said shares shall, except as hereinafter contained, be subject to all the regulations affecting original shares contained in the Articles of Association. 2. That the 5th clause of the Memorandum of Association be altered, and that, as altered, it shall be as follows, that is to say:—5. The capital of the company is £750,000, in 37,500 shares of £20 each. 3. That in order to represent £68,765 0s. 10d., which at the date of the last balance-sheet, 31st of December, 1872, had been expended on capital account, and £18,690 2s. 2d., since expended, making together £87,455 3s., and a further expenditure of £32,544 17s. proposed to be made, which sums amount in all to £120,000, 6000 of the said new shares be forthwith issued to the existing shareholders, credited as fully paid up; and that, to meet such credit, the sum of £120,000, part of £127,006 18s., which, on the 31st of December, 1872, was standing to the credit of the insurance and contingency fund, be carried to the credit of the capital account; and that the said shares shall not be subject to the payment of any part of the amount thereof in cash. 4. That the said 6000 shares shall be allotted to the persons who shall, on some date to be named by the board, be the registered holders of the shares previously existing, *pro ratâ*, in proportion to the number of shares respectively held by them; and that, in case the number of shares held by any of the shareholders is such that the precise number of new shares to which they would respectively have been entitled, in proportion to the number of old shares held by them, cannot be allotted to them without making fractions of a share, the board shall be authorized to sell the shares by which such fractions shall be represented, at such time, in such manner, and at such price as they shall think fit, and to pay the proceeds thereof in the proper proportions to the persons who would have been entitled to the fractional shares. 5. That the remaining 1500 shares shall be allotted, sold, or otherwise disposed of by the board, at such time and price, and upon such terms and conditions as they shall think fit.

MALTA AND MEDITERRANEAN GAS COMPANY, LIMITED.

The Ordinary General Meeting of the Shareholders of this Company was held at the London Tavern, on Thursday, June 19—Lord ALFRED HERVEY in the chair.

The SECRETARY (Mr. E. P. Rowsell) read the notice convening the meeting, and the following report, with statements of accounts annexed, were presented:—

The directors have to submit the balance-sheet of the company for the twelve months ending the 31st of March last.

After placing £300 to the reserve-fund, and providing for interest on debentures, together with a dividend of 7 per cent. on the preference shares, there remains a sum sufficient to pay 3 per cent. on the ordinary shares, free of income-tax, and to carry forward a balance of £591 4s. 2d. to the next account.

General Balance-Sheet, March 31, 1873.

Dr.				*Cr.*			
To Capital—				By Preliminary expenses and sundry accounts (balance)			
£5 per share on 15,000 ordinary shares	£75,000	0	0	Outlay at the stations	£1,158	0	9
Less discount on shares authorized, 1868	3,000	0	0	Suspense accounts	128,473	4	2
	£72,000	0	0	Commission on debentures (balance)	262	0	6
£5 per share on 6000 preference shares (7 per cent.)	30,000	0	0	Furniture, London office	116	4	6
	£102,000	0	0	Goods in transit	94	15	1
Loans on debentures	43,000	0	0	Sundry debtors	15	9	7
Bills payable	3,782	9	11	Bills receivable	5,582	7	11
Sundry creditors	1,777	19	0	Stocks	1,150	0	6
Reserve-fund	1,199	10	9	Cash	15,234	1	9
General revenue	3,891	4	2		3,514	19	7
	£155,601	3	10		£155,601	3	10

Profit and Loss, for Twelve Months ending March 31, 1873.

To Coal				By Gas	£19,752	17	9
Gas-making (salaries and wages)	£8,319	3	2	Coke	2,612	2	5
Charges on street lights	2,302	14	0	Tar	61	1	6
Wear and tear	1,133	3	9	Meters	44	18	4
Lime and purifying	889	9	1	Rental of Meters	418	6	10
Rents	149	11	2	Stock	156	4	0
Stoves	58	16	9	Rents	8	0	10
General expenses	10	18	1	Sundries	65	8	10
	1,064	7	6		£23,119	0	6
	£13,928	3	6				
Bad debts and allowances	36	1	4	Profit on fittings sold	90	1	0
Income-tax, paid in Sicily	69	9	8	Rental of fittings	112	8	6
Audit fee, Malta	21	0	0		202	9	6
	126	11	0	Transfer fees	5	7	6
Preliminary expenses and sundry accounts, instalments of	386	0	2				
London expenses	973	7	9				
Exchange	£303	3	9				
Interest on debentures	2,791	5	10				
Interest and discount	110	17	7				
Income-tax (balance)	54	11	11				
	3,259	19	1				
Revenue	4,652	16	0				
	£23,326	17	6		£23,326	17	6

General Revenue Account.

To dividend on preference shares (7 per cent.), paid in December, 1872, on account	£1,050	0	0	By balance from last account, after payment of dividends	£588	8	2
Reserve-fund	300	0	0	Profit and loss	4,652	16	0
Balance	3,891	4	2				
	£5,241	4	2		£5,241	4	2

The CHAIRMAN, in moving the adoption of the report, expressed the regret he felt at the loss the company had sustained by the retirement from the chair, through ill health, of their highly esteemed friend, Mr. Nicol. It was, however, he said, satisfactory to know that Mr. Nicol still retained a seat at the board, and was always ready to afford to his colleagues the benefit of his experience and great knowledge of the affairs of the company. The report just presented, though brief, contained all the information the directors could give or the shareholders require. No doubt there would be a feeling of disappointment experienced by the latter on finding that the dividend this year was reduced from 5 to 3 per cent.; but, as the report told them, this diminution had been caused entirely by the increased cost of coal during the past year. The total charge for coal in 1872 was £8319; in 1871 the charge was only £6448, so that last year the extra cost was £1871. It required £750 to pay a dividend of 1 per cent. upon the ordinary shares, so that it was evident the additional cost of coal last year more than accounted for the 2 per cent. diminution of dividend on this occasion. Taking the present price of coal, and assuming that it had prevailed during the whole of last year, the burden would have been much more serious. It was the fact of the comparatively low price of coal at the beginning of last year which helped to diminish the average, for had present prices ruled all through the year, the entire 5 per cent. dividend would have been swept away. Added to this source of diminished profits, there was also last year an increase to some extent in the debenture interest. It amounted to £278 more than in the previous year. This was partly owing to the fact that the directors had had to raise money for working capital, and partly to the additional interest they had had to pay for debentures. And this reminded him to state that there were some debentures at the present moment which the directors would be glad if the shareholders would assist them by taking up, and thus relieve them from one of their difficulties. Having glanced at the dark side of the picture, he might briefly refer to some indications of an improving state of things. In the first place there was an increase in the gas-rental. For 1871 the gas-rental amounted to £19,138; last year it was £19,752, showing an advance of £614; and he thought they might fairly hope for a still further increase this year. As stated in the report, the directors had felt it necessary, in consequence of the high price of coal, to give notice to their private consumers in Malta of a rise in the price of gas. The change would take place from the beginning of July, and the agent of the company there estimated that it would produce this year an additional revenue of £900. It was also proposed to make some alteration in the mode of collecting the money, and to insist on the whole being paid in English currency, which it was calculated would make a difference to the company of £200 in the item of loss by exchange. He would be a bold person who would venture to predict the future price of coal, but the general opinion seemed to lean in favour of a reduction. A reduction of 2s. 9d. per ton on coals was equal to 1 per cent. upon the ordinary shares of the company, so that should the average price for this year show only a moderate diminution, the shareholders might at least hope to see the former rate of dividend. A question might arise in the minds of some shareholders with reference to the value of coke, which it was usually supposed would to a large extent compensate a company for the enhanced price of coal. This was not the case at Malta, owing to the extreme cheapness at which charcoal could be purchased. Last year the sales of coke amounted to £2612, the year previously to £2714, and in 1870 to £2996. Speaking at the present moment, he was happy to say there was some improvement in the price, which, if it continued, would make an important difference to the company at the end of the year. In conclusion, he remarked that it was not proposed to fill up the vacancy at the board caused by the retirement of Mr. Duckworth, as it was felt that five directors were sufficient to conduct the affairs of the company.

Mr. S. ANDREWS seconded the adoption of the report.

Mr. WHITE asked whether the board were under any contract for coals at the present time.

The CHAIRMAN said there was no contract in existence. The directors purchased coal as they wanted it, and at the best price possible.

Mr. H. P. STEPHENSON asked whether the board had power to raise the price of gas at the two unfortunate stations of Trapani and Marsala, and, if not, whether they already had or would speedily take into their serious consideration the suggestion he had made on several former occasions to sell those works for what they would fetch, or even to give them away. There was no doubt in his mind that a good profit was being made at Malta, but the whole of that profit was being sucked up and absorbed by the other stations. He believed that if the company gave the latter works away they would be much better off.

The CHAIRMAN said there was no power to raise the price of gas at Trapani, but it was higher there than at Malta. All they could do was to work on, trusting the time would come when those stations would pay.

Mr. DODGSON said he thought the shareholders ought to have a return laid before them from each of the stations showing where the profits and losses were made.

The CHAIRMAN said all the information desired could be obtained at the office, but it would be most injurious to lay the figures before a public meeting, and therefore he must decline to give them.

Mr. DODGSON asked for information as to the increased outlay at the stations during the year, which amounted to nearly £3000, also as to the increased investments in "stocks."

The CHAIRMAN said it would be difficult to carry all these details in his mind, but he might state as to the first item that there had been an expenditure at Malta in sundry necessary works.

The SECRETARY stated that the stocks consisted of coals, fittings, and other things. The amount of these varied from time to time, and he was not aware that there was any marked increase at the close of last year. The £3000 additional, invested in "stocks," was largely represented by the enhanced price of coal.

A SHAREHOLDER asked whether any information could be given to the meeting as to some of the various new schemes advertised—whether the position of the company was likely to be affected by them, or whether they could be made available for the purposes of the company.

The CHAIRMAN said the attention of the directors was called to them. Of course they would not spend money in useless experiments but as soon as any of the new inventions proved successful they would be willing to avail themselves of any advantages offered by them.

Mr. WHITE asked the engineer for an explanation of the small return from the sale of tar.

Mr. HODGSON JONES replied that a large portion of the tar produced was burnt under the furnaces. The remainder was sold under a contract with the Admiralty at a low price.

A SHAREHOLDER, referring to the difficulties sometimes arising in the issue of debentures, asked whether it would not be policy on the part of the directors to issue a debenture stock.

The CHAIRMAN said he thought the idea was a good one, but the difficulty was to get persons willing to come forward and float it.

The motion was then put and carried.

The CHAIRMAN moved that a dividend at the rate of 7 per cent. per annum be declared on the preference shares for the twelve months ending March 31, 1873, deducting the payment already made on account.

Mr. NICOL seconded the motion, which was carried.

The CHAIRMAN moved, and Mr. ANDREWS seconded, the declaration of a dividend at the rate of 3 per cent. on the ordinary shares, free of income-tax, which was also carried.

Resolutions were also passed reducing the number of directors to five, re-electing Mr. Romanes as a director, and Messrs. M'L. Backler and J. L. Daniel auditors of the company.

The diminished dividend which the company has earned during the past year is more than accounted for by the extraordinary increase in the price of coal, which has so greatly affected the profits of every gas company. Had it not been for this untoward circumstance, the increased receipts for gas would have justified the directors in recommending some addition to the dividend on the ordinary shares for the year just ended.

With much regret—but hoping that it will need only to be a temporary measure—the directors have been compelled to somewhat raise the price of gas to private consumers at Malta.

On the 1st of July next, certain debentures of the company fall due, and tenders are invited for loans on that security, in sums of not less than £100, for a period of three years.

The retiring directors are Robinson Duckworth, Esq., and John Romanes, Esq. Both are eligible for re-election, but Mr. Romanes alone offers himself; Mr. Duckworth refraining from doing so in consequence of ill-health.

The auditors, Henry M'Lauchlan Backler, Esq., and James Le Geyt Daniell, Esq., also retire, and are likewise eligible, and offer themselves for re-election.

Mr. BACKLER, in returning thanks, remarked, with reference to the tendency of the coal market, that he, as being connected with a large foreign gas company, had that morning received numerous offers of coal at a reduction of 3s. per ton.

Mr. HERSEE said no definite propsal had been made to the meeting on a subject referred to in the report—viz., the provision for meeting the debentures which would shortly fall due. He thought it would be well if the directors were to issue a circular to the shareholders respecting them.

The CHAIRMAN said he had never found any good arise from the issue of circulars. It would be better to meet together and talk the matter over.

Mr. HERSEE said what the shareholders required was information on the subject.

The CHAIRMAN said there could be no objection to the issue of a circular, but he was not sanguine as to the result.

On the motion of Mr. WHITE, seconded by Mr. DODGSON, a vote of thanks was given to the directors for their services, and also to the chairman.

The CHAIRMAN acknowledged the vote, and said the directors did all in their power to advance the prosperity of the company. The price of coals was a matter altogether beyond their control, and had that not been so adverse the company would have been able for the past year to pay 5¾ per cent. on their ordinary shares.

BRITISH ASSOCIATION OF GAS MANAGERS.*

(*Continued from page 552.*)

TUESDAY, JUNE 10.

After the delivery of the President's Inaugural Address,
Mr. J. ELDRIDGE (Richmond) read the following paper:—

ON THE APPLICATION OF "COFFEY'S STILL" FOR THE EXTRACTION OF AMMONIA.

At most of our annual meetings the attention of members has been called to the various modes of washing, scrubbing, &c., with a view of extracting ammonia and other impurities from the gas before it reaches the purifiers.

When sulphate of ammonia is made in large quantities a vessel called a "column," or "Coffey's still," is used, in which ascending steam is made to come in contact with descending streams of ammoniacal liquor, and the ammonia thus becoming vaporized passes from the still through a pipe to the saturator.

A similar vessel is sometimes, though not frequently, used on gas-works. I have one in use on our works, and as it has proved very effective I now propose to give a brief description of its construction and working for the benefit of those who may not have seen one. It can be made of any dimensions. The one shown on the drawing is 24 feet high, 4 feet wide, and 2 feet thick, cast in eight 3-feet lengths, with flanges, and put together with bolts, nuts, and lead pipe in the usual way.

From below the outlet to just above the inlet are a series of shelves 3 feet 4 inches long, and about 8 inches apart, thus leaving an opening of 8 inches by 24 inches at each end. These shelves rest on fillets cast on the side of the still, the open end of the one being over the end of the other, which is not open, and in some measure resembles a series of steps. On the open end of the shelf is a ledge half an inch high, so that each one has always water over it to that depth. The water is pumped in at the top of the still through a 2-inch pipe, when it falls on the first shelf, runs over the ledge at the end to the next one, and so on down through the whole till it reaches the bottom, thus forming a continuous stream of 2 feet wide and half an inch thick, as well as a series of small waterfalls. The water runs out at the bottom into a tank, where the outlet-pipe is, of course, sealed in the usual way.

The pipe through which the water is supplied at the top may be of any size, or can be regulated by a valve so as to give whatever quantity may be thought necessary, according to the make of gas. The gas entering at the bottom of the still passes backwards and forwards in the course of its ascent, and comes in contact with all the descending waterfalls, and, of course, over the water on each shelf.

On the works of which I am manager we have a good-sized coke scrubber, through which we pump the ordinary ammoniacal liquor over and over again at the rate of about 1000 gallons per hour, till it is about 16° of strength. The gas then passes through the still, in which water is used at the rate of 1000 gallons per hour, till it is about 8° of strength, and it is then used for making sulphate.

A large quantity of ammonia passes from the coke scrubber into the still, where it is arrested, it being impossible for the gas to make its way up to the outlet without the whole coming into contact with the descending fluid.

In the ordinary coke scrubber the tar and coke frequently become nearly a solid mass, causing a great deal of pressure. Mr. Anderson, when speaking on this subject at Nottingham, in 1867, said "he had seen, at the opening of scrubbers, certain sinuous channels through the coke, which channels were glutinized with tar."

In the still the least obstruction is impossible, and the pressure is therefore *nil*—a feature which all managers will readily appreciate. I am aware that scrubbers charged with boulders, brickbats, broken bottles, drain-tiles, &c., or fitted with boards, are less liable to become obstructed by tar than those containing coke; still the remarks about pressure apply more or less to the whole.

Another advantage of the still is that it requires no distributing apparatus; the water is simply pumped in through the pipe on the top, and rushes from shelf to shelf till it reaches the bottom.

We all know that in the ordinary coke scrubbers there are frequent difficulties in the distribution of the liquid. The "Barker mill" will sometimes get out of gear; the revolving brushwood—excellent as the plan is—sometimes gets clogged with tar; the simple perforated pipe becomes partly stopped, so that it is not an uncommon thing for the gas to be passing through what may in some measure be called a dry scrubber. This is impossible with the still.

Another advantage is that the still is very simple and economical in its construction.

I wish to say, in conclusion, that these few remarks on rather an important subject are respectfully offered to those who, like myself, are managers of comparatively small works. Speaking from experience, I have always found in the use of the still that the whole of the ammonia has been taken out of the gas, and of course utilized, and the expense of purifying materially reduced.

My object in reading this short paper will be attained if I have succeeded in bringing to the notice of my brother managers a vessel which I think ought to be better known and more in use on gas-works than it is at present.

Mr. ELDRIDGE said that Mr. Sugg first called his attention to the Coffey still, and strongly advised its use. He might further state that Mr. Barclay, of Tottenham, had used the still with great success for a number of years.

Mr. MAY (Canterbury) said he should like Mr. Eldridge to explain to the meeting how he got rid of the tar which accumulated on the shelves.

Mr. DOUGLAS (Waltham Cross) remarked that the application of Coffey's still to the manufacture of sulphate of ammonia was no new thing.

Mr. SYMS (Rochester) suggested that the value of the process would be much more intelligible to the meeting if Mr. Eldridge would give the proportion of water per 1000 cubic feet of gas instead of the quantity passed per hour.

Mr. WARNER said the reader had suggested doubts as to the stoppage of washers, but for his own part he could not understand why boards placed perpendicularly, or only at a slight inclination, should be more likely to stop up than horizontal bars. In the paper read before the association upon scrubbers, two years ago, it was clearly shown that with boards such as Mr. Livesey and he (Mr. Warner) employed there was no tendency to stoppages.

Mr. WATSON (Sydenham) asked for information on two points—first, whether Mr. Eldridge relied entirely upon this scrubber—for after all it was a scrubber—for the removal of ammonia; and secondly what amount of ammonia per 1000 feet was left in the gas after passing through it.

Mr. GEO. ANDERSON (London) said he had been in hopes that the paper just read would have gone into some statistics as to the manufacture of sulphate of ammonia, because the fact of that article being made by Coffey's still was an old affair. All the members of the association who were present at the meeting held in London some seven years ago, and paid a visit to certain chemical works there, had the opportunity of seeing the manufacture of sulphate of ammonia upon a large scale entirely by the use of the Coffey still. Perhaps Mr. Eldridge in his reply would be able to furnish the meeting with some facts showing the economy of the process he adopted, the amount of acid necessary, the quantity of coals used per ton, and such other practical statistics as would enable them to judge of the value of the process as compared with other modes of manufacture. If he (Mr. Anderson) understood Mr. Eldridge aright that gentleman said he used a second still; if so, that was not a good mode of extracting ammonia. Mr. Eldridge stated that while the gas was passing upwards he had a stream of water passing at the rate of 1000 gallons per hour down the various shelves of this apparatus, and that in this way such a neighbourly action went on between the gas and the water that the ammonia was extracted. Now he (Mr. Anderson) must say he was afraid that there being a space over the water on each shelf and between it and the next there would not be so good a contact as if the gas had to pass through and alongside pieces of coke, saturated with water, of various sizes, large at bottom and small at top of the scrubber. Unless means were taken to cause the gas in very fine particles or divisions to pass through the scrubber, he did not believe the ammonia would be extracted profitably from the gas. There was also another remark to be made. If the gas were allowed to go into the scrubber before the tar and all the liquid products were thoroughly extracted from it, he should not call that good engineering. In order to do that as far as possible in the works with which he was connected he used a water washer. In that washer he put the washings of the scrubber, as also the ordinary ammoniacal liquor from the works. By passing the gas through the ammoniacal liquor he got rid of the tar; and he might here state that he had a scrubber in use at the present time which had been in action since 1864 or 1865, and had never been opened until last week. It was then opened by his direction, not because it had ceased to act, but because at this season of the year it was well to inspect every kind of apparatus on the works. Certainly this scrubber had been in action during the whole of the time he had named, and there had never been anything wrong with it. He believed the cause of this was that he got rid of the tar before the gas went into the scrubber. In that scrubber he did not use ammoniacal liquor as Mr. Eldridge did, because he did not believe that by so doing he could entirely, though perhaps he might partially purify his gas from ammonia. If they passed gas through ammoniacal liquor of 6 oz. strength, for instance, and then passed it through water or ammoniacal liquor of 12 oz. strength, they would have their gas pure. To purify gas from ammonia they must either use some acid or allow the gas in passing last through the scrubber to pass through pure water. If they pumped ammoniacal liquor over and over again up to 16° strength, what was the result? Each time as the liquor became stronger and stronger the less affinity had it for extracting ammonia from the gas. Now he contended that all this pumping over and over again was a mistake. They had no business to pump at all, and if their scrubbers were properly constructed they had no necessity for it. They should put through their scrubbers as much water as was equal to the ordinary quantity of ammoniacal liquor. He was in the habit of putting 10 or 12 gallons of pure water through his scrubbers from the top, and he thus obtained 20 to 22 gallons of ammoniacal liquor per ton of 12 oz. strength throughout, and he had a practically pure gas. He believed that if the scrubbers were made high enough and the water was put through slowly, there would never be any necessity for pumping. Then in addition to the scrubbing there should be a previous washing to prepare the gas for the scrubber. Thus operating, they could, by methods long in practice and well known, perform all that was possible of attainment by any new and fanciful processes.

Mr. ELDRIDGE, in reply, said Mr. May had asked how he got rid of the tar. His answer was he had never seen any tar in this still at all. He passed the gas first through a coke scrubber, and in that there was very little tar because he thoroughly condensed his gas, but in the still there was none. And even if any tar passed to the still it would not clog up the apparatus, nor obstruct the way of the gas. Mr. Syms asked the quantity of water per 1000 cubic feet he employed. At the present time in his works he used 1000 gallons per hour, passing about 7000 cubic feet of gas during the same period. Then Mr. Douglas said there was nothing new in the Coffey still. He (Mr. Eldridge) did not say there was. All he said was that the apparatus was used in some works, and it would be better if used in more, and his intention in reading the paper was to call the attention of those gentlemen to its value who had never hitherto employed it. Mr. Warner did not agree with his comparison of this still with scrubbers in which boards were used. But he did not mean to say that in all cases where boards were used there must necessarily be stoppages, but that there was a tendency in almost all of them to that result, whereas in the Coffey still it was perfectly impossible. Mr. Watson asked whether he depended upon this still alone for the extraction of his ammonia. He had already stated that he first used a scrubber charged with coke, which took out a considerable portion of the ammonia, so much so that by pumping the ordinary liquor over and over again, he got it up to 1403 strength. Nevertheless a great deal of ammonia did pass to the still, otherwise he should get the water pure. He found, however, in the winter that after using the still for a day or two the water came up to 7° or 8° of strength. Mr. Anderson and Mr. Watson both asked for statistics. All he (Mr. Eldridge) could say was that he had not gone into them at all, and did not read the paper with any reference to the manufacture of sulphate of ammonia. He therefore could not answer the question as to the amount of acid necessary, nor the quantity of coals used in the manufacture per ton of sulphate; his

* In giving in the last JOURNAL a list of the gentlemen in Scotland who so handsomely entertained the members of this and the North British Association, the following were accidentally omitted:—Mr. D. M. Nelson, 135, Buchanan Street, Glasgow; Messrs. Hurl, Young, and Co., Glasgow; Mr. Alex. Thomson, Queen's Terrace, Glasgow.

We have received a print of the group of members and friends photographed by Mr. Stuart, at Tarbet, on the day of the excursion, and have much pleasure in mentioning the fact, having had several inquiries on the subject. We are sure that many who were present will be glad to possess themselves of this souvenir of an event which was so full of interest and enjoyment. The photograph is admirably executed. The copies, we believe, are 3s. each, and applications for them should be sent to Mr. Stuart, 120, Buchanan Street, Glasgow.

object had simply been to show the utility of the still in the manufacture of gas. He might state that only a short time ago he had occasion to stop the still for about twelve hours, and his purifiers were off twelve hours sooner, which he thought was conclusive proof with regard to the value of the apparatus in purification. Since he had had the still in operation the produce in sulphate of ammonia had been very much greater. The question was asked whether the still did really take out the ammonia. The fact he had stated, that by using clean water he obtained, after a while, 7 or 8 oz. liquor, was a proof that it did take it out.

The PRESIDENT said the association was much indebted to Mr. Eldridge for his paper, which had brought the subject before the meeting in the shortest possible way, and which contained a great deal of useful matter. With regard to the Coffey still, Mr. Eldridge had very fairly stated that he did not bring it forward as anything new. To his (the president's) knowledge this still or scrubber had been used in the manufacture of sulphate of ammonia for a very long period. The first application of what might be called an approximation to the Coffey still, was a condenser erected by the Dover Gas Company 30 years ago. It was in the form of a flat worm. The hot gas was admitted at the top and the cool gas passed out at the bottom, so that the condensible matter met the gas in the opposite way, and it was the most effective condenser he knew of. The same plan was adopted by Mr. Barclay, at Tottenham, where the main was put up as a boundary to the works. It was laid in a horizontal position, with a slight fall. The gas went in at one end, the condensible matter met it in the opposite direction, and it became a most effective scrubber.

Mr. WARNER asked whether the condenser at Dover was in use before one of the same kind was used at Birmingham.

The PRESIDENT said he could only state that it must have been about 30 years ago.

Mr. GARNETT (Ryde) said there was one at Portsea 35 years ago.

The PRESIDENT remarked that it was thus we sometimes thought we had something new, which, upon investigation, was found to be very old.

Mr. WARNER (South Shields) read the following paper:—

ON THE DISTRIBUTION OF GAS AND THE IMPORTANCE OF HAVING A COMPLETE AND PERFECT REGISTER OF DISTRIBUTING PLANT.

This title is exceedingly comprehensive, though the subject is entirely beyond the scope of a single paper. I shall therefore deal with it in a similar manner to that of the governor and governor-house—dwell rather on the broad principles of a systematic arrangement of the work than enter into its details. The subject, though not attractive, is one of considerable importance; indeed, to some companies, none more seriously affects their interest than distribution. With a normal rate (if it can be fixed) of "unaccounted for"—say 15 per cent.—there is much in the subject to engage the closest attention of gas managers; but with 20 and 25 per cent. and upwards, and with complaints more or less frequent of irregularities and insufficiency of supply, we have in this subject one that demands thorough discussion by the practical and experienced members of this association. To commence the work, I enter a town and take stock, as it were, of the distributing plant—mains, services, meters, and public lamps. The latter being the easiest to dispose of, I take them first, and will follow the others in the same way, the inverse order in which they are placed—meters and services, then mains, and matters pertaining to each severally at the same time.

For distinct and separate account of the work, and for the purpose of a perfect check, I use in some cases three "forms." The first for "The order in which lamps are lighted in walks," which has columns for "Name of street or place," the "Number of lamps" in it, and the "Numbers on the lamps."

From this we get then the total number of lamps lighted from the number in each "walk." This work is then checked by the next "form," "The arrangement of streets, places, &c., in alphabetical order," with columns for the same, "Number of walk," and "Number of lamps in the street." These two "forms" are sufficient for towns with *each street* numbered from unity; but in towns with the lamps numbered consecutively in the town, another "form" is necessary to register them in this order; this has columns, as in the other "forms," for "Street," "Number of walk," "Number of lamps," and "Numbers on lamps." A word on the two systems of numbering. The latter *appears* to be the most simple, but practically the former is the most satisfactory, as each street may have its lamps altered, and the number increased or diminished without affecting other portions of the town; but when arranged consecutively, alterations in position or number create considerable confusion. In the inspection of the lamps, each one has a mark painted on it when booked, to denote the same, and at the same time the pillar, &c., are inspected, and the condition reported. The "form" of "Daily report of public lighting" is shown in next diagram; its columnar arrangement is—"Number of walk," "Name of lamplighter," and for each day in the week, "Number of lamps in walk," "Number not lighted at night" (ordered or otherwise), "Number out in the morning;" at the foot of the page are lines for details of alterations, and change of number is at once made in the "walk" in which it occurs, and the total number at foot of column corrected. There are also columns for totals "Not lit" and "Found out," which are made up of the cross castings of daily reports; thus is shown the comparative condition of each man's walk. The totals are also compared with "Police report of lamps out," in line at the foot of the tabulated arrangement.

In the general inspection of a town for the purpose of ascertaining the condition of the plant and nature of the supply, nothing less than a house-to-house visitation will be satisfactory.

In this city I believe it is customary to have an annual inspection of this character; but then the social conditions here are different from English towns, and what is *necessary* in a large Scotch town, with its dwellings in great blocks of buildings arranged in "flats," and gas circulating freely through many, very many tenements, is not required in a quiet English town in the south of England. It is, however, necessary in *every* town that a *thorough general* inspection should be made more or less frequently, according to the character of its inhabitants and the nature of the district. For this inspection I have a "General inspection book," arranged with columns for "Names of streets," "Number of houses in the street," "Names of consumers," "Number of house," "Number of burners," "Size and description of service," "Size of meter, wet or dry," "Number of meter, and owner," "Date of meter," "Maker's name," "Last date of repairs of meter," "Private lamps, number, and how supplied," "Condition of service and meter, and remarks." From this book are posted the services into a permanent "Register of houses and services." This is arranged with columns of "Streets alphabetically arranged" and "Number of houses;" it has also linear and columnar spaces equal to the number of houses, for the size and description of service, also space for detached buildings, unnumbered houses, remarks, &c. As this is a permanent register of services only, it is not used for totals or yearly reports. The "form" for this work is shown in the next diagram, which condenses the work, and gives the total number of each size of service and description in each street. We have now to return to the "General inspection book" for meters; and this subject, I am afraid, we shall find a little more complicated, as we not only require the *sorts* and *sizes*, but the *dates*, to form a true estimate of the character and value of these important and valuable instruments. With such a mass of figures as there must be in every good-sized town, it is necessary to have a frequent and perfectly satisfactory check as the work proceeds, and for this purpose the inspection book is analyzed page by page, and at every tenth folio the preceding pages are summarized, as shown in the diagram of "Summary of pages." The total quantities of each sort, wet and dry, and the owner, company or consumer, are thus brought together. Under the two major headings, "Company's" and "Consumers" are arranged columns of sizes and lines of dates, the two top lines being "No date" and "Prior to 1854," and under these are lines for the 20 years up to the present time. Wet meters are entered in red, and dry in black ink. The casting of columns will give the total number of each size of meter, and the cross casting the total number in each year, the castings and cross castings agreeing with the previous totals of pages, the work is correct. If the total stock of meters in use was covered by the ten pages of the inspection book, it will be seen that nothing further would be required, as we have the total number of each size in each year, and the total number of each year, also the total number of each size. In towns, however, with many consumers, it will be necessary to make an abstract of the work, and arrange it under its several years with columns of folio, summary, and sizes, which, by casting, will give the total number of each size in every year, as shown in the next diagram. These, copied into the previous "form," will give the stock. The same "form," with lines at the bottom for "Meters up and down," will give a simple and thoroughly reliable report of the meters in use.

I pass on to mains. Clegg says: "Experience has made manifest how necessary it is to have a perfect record of every feature in this part of gas lighting, and a good plan drawn to a large scale is the only available method that can be adopted; no written description will answer."

For the purposes of distribution, doubtless he is correct; but as a record of the work a map falls far short of a tabulated system. His remarks upon the want of a map may be well applied to himself upon this point. "Errors entailing a permanent expense and inconvenience have been the result of the operations of most of the great companies from this simple point having been neglected." He instances a case of twelve syphons having been used in the place of two; but surely here a list of syphons, with their position defined by their distances from fixed points would have been equally useful as a map, had reference been made to the list.

I do not wish to undervalue the advantage of the map; indeed, to quote Clegg again: "I would as soon think of making a steam-engine without a drawing as lighting a town without a map." I, however, contend for the advantages of a good and *full*, but simple registration of mains and their appurtenances. As an instance of the value of this in its crudest form, I have reported every day the position and size as well as the condition of each main as it is opened up, and so check the register and correct the map.

A list, too, of mains, with size, position, and their syphons, may be made, and made useful, by persons quite unqualified to prepare a plan. Such, too, would be far preferable to what I met with in one town in which I have been engaged. Upon inquiring about the mains, the reply was, "Oh, yes; we know all about the pipes. I will *walk over them* with you any time." I am afraid that this is the only reply that could be given to the question if put in some other places. Again, the written description is much better, more reliable, and more useful than the spider webs to be met with.

I place before you a genuine article of this kind, an official document, and, to do it justice, it is much more useful than many a one of a more pretentious character, or those maps with *mains drawn to scale*, or the sizes shown by different colours.

In a town in the south of England I met with two of such maps, one of which must have cost rather a long sum for mounting alone, as it was prepared in many sections, and some of these could not be fitted to each other for reference. To instance the necessity of *great care*, saying nothing of skilled experience, in the preparation of such plans, I give a sample of what I met with there; in one case a 3 inch and 4 inch were shown on one map, on the other a 5 inch, and another "walking over gentleman" thought it partly a 5 inch, but when examined it proved to be a 3 inch and a 4 inch. In another case a 3 inch was shown in several streets on the first plan prepared, but no main was shown on the second plan, nor was anything known of one by the principal men; a 3 inch, however, was found. Another case, a 3 inch was shown on one, and a 4 inch on the other. One more case only will I trouble you with. On one was shown a 4 inch and part of a 3 inch, and the other partly 5 inch and 3 inch; but on examination neither was correct, there being a 5 inch and a 3 inch the whole length. Hence the necessity of a system of constant supervision, registration of the work, and correction of the map.

The first "form" for this purpose is that of "Details of mains in streets alphabetically arranged." The columns are "Name of street," "Length of street in yards," Size of main," "Depth of main," "Length in yards," "Measured from starting point at——." "Starting point" is defined under "Remarks," the heading of last column, as "the point of intersection of lines drawn from the opposite (diagonal) corners of the streets or places." This plan clearly fixes the position of the main, which the next column is for the purpose of giving, the heading of which is "Distance of main from right-hand side of way, walking from starting point." The following columns are "Distance of valves and syphons from starting point," "Date of laying," and "Cost per yard." The next "form" is "Register of mains." This is alphabetically arranged with column for the purpose, also one for length of streets; the other columns are for each sized main, from the lowest to the highest in the town, and several blank ones for larger mains when laid; there are also columns for "Mains through parishes or districts to supply adjacent ones," and "Remarks." The first minor column of "Size and length of main" is for pipes "under 2 inches."

I hope you will not think it out of place to quote Accum, 1819, as an authority on gas lighting, a case having occurred some time since as to the definition of "Mains." "The name of mains," he says, "is given in the strictest sense of the word to the cast-iron pipes from 2 inches in diameter and upwards, placed underground, for conveying the gas into smaller branch pipes; *but in a more extended* sense the term is applied to every pipe from which smaller ramifications or branch pipes proceed." The next "form" is for the registration of "District governors," "Valves," "Cocks," "Syphons," and "Standpipes." The last diagram of this series is that of "Yearly summary of mains and services laid and cost," with details of cost. The whole of the distributing plant may now be brought together in one sheet, forming thus "A synopsis of mains, services, meters, and public lamps" in each parish or district, with lengths of streets and number of houses in the same as shown by diagram. This sheet, I need scarcely add, is invaluable for reference and comparison; at one glance may be seen the quantities of mains of each size in each district, also the total quantity, and the same with meters and public lamps; also what proportion the length of main bears to length of streets; and what proportion of houses are supplied with services; and quantities of companies and consumers meters, and the totals.

In the matter of mains I have shown the importance of inspection and registration, in public lamps there are proofs of the same pressing necessity, from irregularity in the work through the change of men or otherwise, and in the fact of lamps having been discovered that were never charged for, and by reference to the "General inspection book" it will be seen that there is not, at least, less need of inspection and classification. The sheet is a sample page of *bonâ fide* cases that have just occurred in the case of a general inspection; a few, and but a very, very few out of many of the same character. The names of streets and consumers are fictitious, and the names of meter manufacturers omitted for obvious reasons, otherwise the entries are correctly copied from the "General inspection book." Let us look at a few of these cases. It

will at once be seen that if such are to be found in a town where there is a fair amount of inspection and supervision, there cannot be otherwise than a large amount of unaccounted for, and a great many complaints in places less cared for. Look at the list:

No. of Case.	Consumer.	No. of Burners.	Size of Meter.	Service.	Remarks.	Tested. In Normal Condition.	Tested. In Actual Use.
1	E. D. Smythe . .	15	2 lt. D.	—	—	—	—
3	W. Martin	24	5 „ D.	—	1850. Private meter, of which there are two in the list, and one of 1848.	—	—
4	Public Buildings .	232	60 „ W.	—	—	—	—
7	H. Marshall . . .	50	5 „ D.	¾ in.	—	9·09 S.	20·00 S.
10	D. Wilson	25	2 „ W.	¾ „	—	25·00 S.	35·00 S.
12	St. Luke's Church.	195	50 „ D.	—	—	—	—
18	Ramsey and Co. .	22	3 „ D.	½ Id.	—	3·38 S.	8·00 S.
23	Chapel	155	50 „ D.	1½ in.	—	—	—
26	M. Thompson . .	10	2 „ W.	¾ in.	—	Not registering.	
27	R. Lindsay. . . .	16	2 „ D.	—	—	1·01 S.	0·99 S.
10		744	181 lights capacity.				

Some of these meters were subsequently taken down and tested, and the results are given in the two last columns, the first at the normal rate of burning, the second with the total number of burners in use.

One case (No. 10) was as high as 25 per cent. slow, which increased to 35 per cent. when tested with the full number of burners. The next case (No. 7) was 9·09 per cent. slow, increased to 20 per cent. with the full number of lights on.

An increased loss ranging from 0·20 per cent., the lowest, to 4·62 per cent., the highest, in nine cases, is shown, averaging above 2 per cent. loss in each case; and in two cases only is a gain shown—1 per cent. in one case, in the other 0·02.

Though there are but two cases of fast meters on this sheet, yet I must add that we do find meters considerably fast, and therefore the periodical testing will be equally satisfactory to the consumer as to the company. Can there then be, with such a state of things, aught but dissatisfaction with the supply, and considerable loss sustained by the company? And yet, where meters are not supplied free of charge, how difficult it is in many cases to get the consumer to hire or purchase a meter of sufficient capacity.

It will be seen that this inspection brings other matters to the surface—small services, as in case 18; bad inlet coupling; a lead service with end flattened up only; cock left on iron service, &c. The work is thus kept in a satisfactory condition, and the number of complaints kept exceedingly low.

In the matter of distribution proper we have little in theory or practice that was not suggested or in use in the early days of gas lighting—the governor, invented by Clegg, 1815; Malam's meter, 1819; the pressure register, 1823; turned and bored pipes, Peckston (1823) says, "some manufacturers have of late made, and in a comparison of weights of common spigot and faucet pipes there is not much difference in the castings;" and the great principle of modern times, that which has been so beneficial to the metropolitan companies—*districting*—was suggested by Lowe, 1823. Sir William Congreve suggested the use of large public meters on the mains, to show that the quantity of gas delivered by the companies corresponded with their contracts. Here, then, is sufficient proof that considerable attention was paid to this part of our business, and that in theory and practice details were elaborated that we should do well to copy rather than follow "Clegg on Gas Lighting;" for can anything be more opposed to a thorough and economical distribution of gas than what he directs: "It is generally sufficient, and always advisable, if possible, to have but *one* leading main from the works." Last year I had the honour of directing your attention to this subject, and attempted to show the advantage of having several mains from the works to regulate the pressure to the varying requirements of the several districts. But now I do so for another purpose—the *testing* of the districts—that the "unaccounted for" may be reduced.

Indeed, with the great loss sustained by some companies, it may almost be a question for consideration whether it would not be advisable, as it was in the case of pressure, to have a separate instrument for each district rather than one common to the whole—to have a meter or meters as well as a governor upon each main.

There are, no doubt, great difficulties in the way of "reducing the unaccounted for to a standard;" but it is not, as was said upon a notable occasion, "a perfect fallacy to attempt it." By dividing the town into districts, and cutting these up into sections, the leakage upon the mains and services may be traced, and by an examination of the public lamps, close attention to their lighting and extinguishing, and by frequent periodical inspection and testing of the meters, the "unaccounted for" may be reduced to so small a minimum, as to be lost "in condensation." It has been urged that the expense of districting a town is too great for the general adoption of the principle.

Doubtless in some cases the expense would be considerable, but in many towns the changes could be made gradually, and at a comparative small outlay; indeed, in some instances at a less cost than laying a larger leading main, much depending upon the judgment and experience of the engineer and a reliable map, as well as upon the nature of the district.

I have placed upon the table a specimen of service-pipe laid in a box of tar and sawdust in the manner in which I have had all my services laid for some years now, which effectually protects them from corrosion and prevents their disturbance. Also, by the kindness of Messrs. Goldsmith and Dilkes, I have the opportunity of placing before you one of their patent service cleansers; it is no larger than a gas-tubing socket; indeed, it consists of one with a little hollow brass plug to screw inside, and a thimble to hold a piece of paper over this plug, thus forming a chamber for gunpowder, which is fired through the service into the main by a percussion cap in the usual way from a nipple on the other end of the plug. There can be no doubt of their usefulness and practicability, as they are in use by the Chartered, Leicester, Coventry, and Belfast Companies.

My subject is so closely related, indeed almost includes that of a paper to follow, that I am afraid I have scarcely avoided anticipating some of that matter. In this I trust that Mr. Emmerson will pardon me.*

The PRESIDENT asked whether Mr. Warner had any practical proof that, by the inspection which he recommended, there had been a real gain in the matter of unaccounted-for gas.

Mr. WARNER said he had a case in point in which the unaccounted-for gas had been reduced from 25 to 30 per cent. during the last quarter to 11 per cent.

* The forms submitted by Mr. Warner will shortly be published, as was done in the case of the cost price sheets which he laid before the Dublin meeting in 1871.

The further consideration of the paper was adjourned, and this closed the morning sitting.

At the afternoon sitting,

Mr. W. B. EMMERSON (Darlington) read the following paper:—

ON UNACCOUNTED-FOR GAS, ITS CAUSES AND REMEDIES.

This is a subject of vital importance to gas undertakings, and deserves the careful consideration and thought of all engineers and others who desire to see their companies successful in the highest degree. In the observations I have hurriedly prepared, I have no expectation that you will hear anything very new or novel; but rather, that your notice will be directed to some of the causes that in themselves seem insignificant, but which are playing an important part in swelling the account of gas, from which "no revenue is derived." And should the simple remarks thus made have no other result than to elicit discussion, in which some of the more eminent members of our association may favour us with their experience, the time will have been well spent. From meditation and observations made in reference to this subject I have arrived at the conclusion that the causes contributing to increase "unaccounted-for gas" are small in their nature, and to a very large extent under the control of the engineer in charge, but in consequence of the seeming unimportance of each individual cause, they pass almost unobserved and uncared for.

If more care was exercised in small matters of detail in manufacture and distribution, but chiefly the latter, the difference between gas made and sold in many instances would be very much less than at present.

The main object of some managers has been to obtain the greatest yield per ton of coal possible, and in this they have admirably succeeded; and with this object before them their works have been constructed upon the best and most modern principles. In them every appliance has been introduced which has become acknowledged as necessary for large and economic production, and some of us might fairly envy the perfection and method which is exhibited in carrying out their carbonizing arrangements; yet in some of these very undertakings the return to those who have embarked their capital therein has either been *nil* or very small, when compared with the profits of other companies who are not more favourably situated as regards efficiency of apparatus or district of supply.

A ready solution of such an unfortunate case may be found in the difference which exists between gas manufactured as indicated on the station-meter, and the quantity sold as seen in the aggregate return of private consumers meters, public lighting contracts, &c.

In searching for causes tending to increase the "loss account," it will perhaps be better to commence with the gas as measured at the works, and follow it in the distributory apparatus to the meter of the consumer. In doing this you will easily perceive that influences exist in connexion with the measurement of gas at the station-meter, which, if not controlled, would materially add to the leakage account, although they could not possibly affect the gas sold. I need not remind you that the substance with which we have to do is in the highest degree elastic, and that the volume or space which it occupies depends very much on the pressure to which it is subjected, and also on its temperature. So that in order to compare the quantities made and sold, if the temperatures and pressures at which they were measured were not the same, there would be an error in estimating the difference, unless corrections were made to standards of temperature and pressure.

I have seen it stated that 5° of heat increase the volume by 1 per cent., and *vice versâ;* if this be so, it is evident that condensation of gas performs an important part in increasing or diminishing the unaccounted-for gas account.

As an illustration of this, I am acquainted with a work where 10,000 cubic feet of gas per ton was said to be produced from common coal and a very small proportion of cannel, but on the appointment of the present engineer, he found the temperature of the gas at the inlet of the station-meter to range from 75° to 80° Fahr., and the lime purifiers totally incompetent to remove sulphur compounds. This state of matters he attributed to imperfect condensation, and immediately set about improving and increasing the cooling arrangements, so as to reduce the temperature of the gas when measured to about 55°. The result was a lessened make as per station-meter by about 500 feet to the ton of coal, much more effective action on the part of the lime boxes, and a reduction of the "unaccounted for" from 22 to a little less than 18 per cent. Of course, so far as this went, the chief advantage gained was the improved manner in which the purifiers did their work, as the reduction made in the "loss account" did not affect the revenue.

The unsoundness of gasholders has in some cases been found to be a cause of considerable loss, sufficient attention not having been paid to their protection from the influences of the weather, corrosive action of the water in tanks, or gaseous exhalations which hover about gas-works. I have known a gasholder which, when filled and shut off from the town, lost, out of 14,000 cubic feet of gas it contained, 2000 cubic feet in 48 hours, and if the leakage had been allowed to continue would have emptied itself in a fortnight, the holder having been eaten through in several places, not through age and fair wear and tear, but from its being neglected to be cleaned and painted for several seasons previously.

This serious waste ought not to be permitted, nor such depreciation of plant allowed, for sake of the little care and expense entailed upon the application of some paint or other covering, having the power of resisting oxidation, and preserving ironwork from influences which attack it.

Another cause of "loss" may be found in defective main-laying, or in the pipes themselves being disproportionate to the district they have to supply. In many establishments inexperienced men are employed as main and service layers, to whom small wages are paid, the idea being too prevalent that no particular intelligence is required, and that any ordinary labourer is sufficiently qualified to perform the duties of a pipe-layer. This is a mistaken notion, as there is no portion of gas plant in which perfection of action so much depends upon the skill and care of the workmen, seeing that the very life of a gas company may be imperilled by the waste occurring through bad or defective workmanship. It is of the first consideration, therefore, to employ men who are intelligent and thoroughly conversant with the duties and responsibilities attached to the situation of a pipe layer.

Having secured skilful mechanics, the next point to be observed is that none but perfectly sound pipes are used, and it is worth while to employ some means of proving their perfection or otherwise, for where this precaution is not taken it is an easy matter for pipes to be laid in a fractured state, or be in some other sense unfitted to carry gas without waste. Where there is no provision made for testing mains by hydraulic pressure, a blow from a hammer will discover whether the pipe is sound, and service-pipes may be easily proved by having a connexion with a main on the works, to which, at one end, they might be attached, and the opposite end secured by a stopped-socket, and then, after careful inspection, a flame could be run along the pipe, and any imperfect place would at once show itself by the gas igniting.

In laying mains grave errors are often committed, where, for the sake of false economy, small pipes are put down in districts they are inadequate to supply, the result being dissatisfaction to all parties concerned. It would be good policy to let all pipes intended as mains have a minimum diameter of 3 inches, because of the risk of fracturing smaller sizes by drilling them for the insertion of service-pipes. Small mains are fruitful sources of waste in more respects than one; in addition to the danger just named it is necessary to employ excessive pressure in order to give the needed supply to consumers, and it is well known

by all gas managers that there is no more certain method of increasing the "leakage account" than by delivering gas at high pressures; and that, on the other hand, it has been demonstrated that you can in no way secure a better sale of gas per ton of coal than by keeping the initial pressure as low as is compatible with a sufficient supply at the consumers meter, and this can only be accomplished by a well organized distributory arrangement in which the pipes are laid down, sufficiently capacious for the duties they have to perform.

A diversity of opinion exists among gas engineers as to the best form of joint to adopt. Many, having some favourite idea, do not care to buy the suggestions of others, while those joints commonly in use—that is, lead and turned and bored—have each a great many advocates who point out the advantages of the one or demerits of the other; and although much may be advanced in favour of each, I believe that the wisest course is to consider the various circumstances as to the nature of the ground, the ease or difficulty to be encountered in laying the pipes, &c., and these should materially affect our choice. Believing, as I do, in a liberal eclecticism, selecting what seems best under the accompanying circumstances and applying it, the adoption of this principle will be found the most successful method of pipe-laying.

According to the preceding conditions, I would suggest the following as being the most suitable joints:—For instance, if the ground be hard and the line of pipe straight, nothing could be better than turned and bored joints, but if it was made ground, and with any tendency to subsidence, lead joints, from their disposition to become wedged, seem to be indicated. Again, where pipes are laid in shallow trenches, or in ground which from its nature is a good conductor of heat, and there is consequent liability to varying temperatures, causing extra contraction and expansion, there seems much force in the remarks of Mr. Rafferty, of Manchester, which he made at our Liverpool meeting—viz., that under such circumstances rust joints seem very applicable, as the joint and pipe would expand or contract in the same ratio, being of the same material. I have had some experience in the latter class of joints, and consider them to be very sound and durable, and think engineers might give them a more extensive application with advantage.

The patent list has been swelled by the patenting of many methods of jointing, all having for their chief object the reduction of waste. Many of these have been tried with varying results, and I know of none that possess any merit over the ordinary kind, except the one known as "Somerville's patent," a quantity of which I intend to put down for trial, with a hope that they have nearly all the good qualities of T and B pipes, without their rigidity and tendency to draw—a collar of lead run in a groove cast in the socket preventing that, and thus the drawing, one of the chief objections to T and B pipes, has been overcome.

A large number of leakages occur at the connexion of the service-pipe with the main, and I strongly advocate that all holes be drilled, so as to get them perfectly round, and tapped to a good full thread, and not gouged by the chisel, which in many cases results in an irregular-shaped hole and a defective connexion.

The districts supplied by some works are very hilly, and in many cases no provision is made for equalizing the pressure, being excessive in some places, and barely sufficient to meet the demand in others. This state of matters is the foundation of numerous complaints from consumers, some murmuring that the supply is insufficient; others, on the contrary, having so much that their gas bills are very heavy; or their lights are suddenly extinguished, and a great nuisance caused by the water being blown out of the index-boxes. To remedy this, some controlling agent should be introduced into the mains, where this undue pressure commences, preventing the terrible rush of gas to places where there is already an adequate supply. This can be effectually accomplished by the various dry district governors now made.

Public lighting, as carried out in many towns, may be credited with a large quantity of the "unaccounted-for gas." In this department of supply much economy can be exercised, without in the least degree robbing the public of any light they are fairly entitled to. The contracts which companies make with "local governing bodies" are often very faulty, and of the most loose description, the only definite understanding being that so many lamps are to be lighted for a certain time at a fixed cost per lamp. The number of the burner, perhaps, is the only other matter stipulated for. Unless the company in this case were paid an extraordinary price, it will be plain that they must be considerable losers. For instance, if a No. 4 batswing was the burner specified, supposed to be a gauge for the supply of 4 cubic feet per hour, this might be the rate of consumption after midnight when the pressure would not probably be more than 7-10ths or 8-10ths at the burner; but the same burner would consume not less than 6 or 7 cubic feet per hour during the evening, when the pressure most likely would be double.

Calculations made of what the lamps used for a lighting season, on the former quantity of 4 cubic feet per hour, the difference of 50 per cent., when the burners would be passing 6 or 7 cubic feet per hour for several hours each night, would go to increase the "loss account."

Again, in some places the lamps and fittings belong to the local authorities, who arrange for keeping them in repair, by letting the work to some "contracting gas-fitter" for a certain sum per year. In these cases it often happens that the contractor's chief interest is to obtain his money, laying out as little as possible in repairs, and so long as he keeps the fittings so that the lamps can be lighted at all, does not care what leakage may be going on. In a case of this kind, I have known serious escapes remain without attention for several days after the contractor had received notice of the fact.

To remedy this, the lamps ought to be the property of the gas company; if not, arrangements should be made in the contract for a small extra payment for keeping the lamps in good order, which it would be their interest to do.

We now come to the instrument which records the quantity of gas used by the consumer, the "leakage account" depending very much on its accuracy. A well-made gas-meter is now considered a tolerably accurate machine; great ingenuity has been displayed in its construction, and in the application of the principles it embodies; and as now manufactured by first-rate firms, whose reputation is such that they would not stoop to any trade trick in order to increase their profits, but prefer the production of a sound, well-finished, reliable instrument, dependence may be placed upon it as a faithful register of the gas passing through it.

As you know, we have two kinds of meters in action, wet and dry. Each has its advocates, usually adopting one or the other exclusively. The idea forces itself upon me that circumstances should have something to say in the selection of a gas-meter. Cases exist where a dry meter is preferable to a wet one; for instance, where the situation is one of exposure to intense cold, and great trouble is experienced from freezing, or where the position is warm, and in a room higher than some of the lights to be supplied; under such conditions evaporation of moisture takes place, and is deposited by condensation in the fittings below, causing jumping of lights and other unpleasantness. Or where there is an excessive pressure applied to a meter, it frequently occurs, if it be a wet meter, that the water is either blown out of the index-box, or fills the waste-box, giving great annoyance to the consumer, as well as requiring extra inspection to keep the water-line correct, which under such conditions is almost impossible. In any of the preceding instances the advantages of a dry meter recommend themselves. But, on the other hand, should the situation be a cellar, in which there was dampness more than exposure to cold, or where the meter is fixed at a lower level than any of the lights to be supplied, so that condensed vapours from the meter may return to it again, or where the pressure from any reason is small, a wet meter is preferable. In every case discretion and thought should be used in the selection of a meter, choosing one suited to the situation and attending conditions, and the result will be a greater chance of correct registration, less liability to errors or to get out of order, with a material reduction of the "unaccounted-for gas."

But in any case there must be close periodical inspection, a record of the index being taken at each visit by the inspector, as well as of all defects observed, removing immediately every meter found out of action, or in any way unfitted for its work. These are what present themselves to the writer as some of the chief cause of the excessive "loss account" which is seriously interfering with the commercial prosperity of many gas companies. The remedies have, no doubt, already suggested themselves to some of you while I have been reading. The following appear to be some of the most important:—Efficient condensation on the works before the gas is measured. A station-meter in thorough order, to register the gas correctly. Seeing that condensation has been proved to be an important part of purifying, it will be a benefit in two ways—first, it will fit the gas to receive the most favourable and effective action of lime-boxes, whereby sulphurous compounds will be reduced to a minimum; secondly, the gas will be measured at about the same temperature on the works as at consumers meters, preventing the seeming increase in "unaccounted for," so far as it results from difference of temperatures. Provide good large mains, judiciously selecting the kind of joint, care being taken to bed the pipes in soil, so that they are not destroyed by corrosive action, which often occurs in the iron-making districts, where new streets spring into existence like mushrooms, and are formed by depositing slag in the roadways, sometimes to a depth of several feet. An engineer who has this difficulty to contend against recently informed me that he had laid a quantity of new mains, and was compelled to remove them again in a few months; as some of them were by this time eaten through by the action of blast-furnace slag, or mill-cinder. To overcome this, tons of soil have been carted for the pipes to be bedded in.

Employ none but intelligent, competent men to lay pipes, and have every length of main tested before covering in.

In districts of varying levels, insert dry governors to control the pressure, delivering the gas at the lowest possible initial pressure as will ensure an ample supply to the whole district. Excessive pressure only increases leakage as well as condensation in the mains, depositing in the syphons valuable light-giving constituents; the tendency of all gases is to become liquefied as they are subjected to pressure, another result being to increase consumers bills, without giving them any adequate return.

In public lighting, where possible, obtain control over lamp-fittings, and keep them in thorough order; and if lighting under contract, introduce the average meter system, fixing regulators to every lamp.

Let consumers meters be regularly inspected, and use nothing but well-finished, substantial instruments, whether they be wet or dry.

If these suggestions were systematically carried out, with a renewal of those portions of the distributory apparatus most likely to wear out, such as service-pipes, every 12 or 14 years, there can be no doubt that the "unaccounted for" may in almost every case be reduced to 10 per cent. When I took charge of my present works, about 14 months ago, I was informed the leakage was 17 per cent.; but on making up the accounts for last half year, it was found it had been reduced to about 12 per cent.; the improved state of matters having been accomplished by attending to the details before named. I hope to reduce it at least 10 per cent., which is a sufficient allowance for all ordinary cases.

I now leave the subject with the meeting, conscious that I have given you nothing grand, and scarcely touched upon a subject of vast importance; and only hope that the paper may be supplemented with the opinions of the members, many of whom are so much more competent to address you than I am. Should they favour us with their valuable remarks, I shall feel amply compensated for introducing this subject to the meeting.

The PRESIDENT said the association were much indebted both to Mr. Warner and Mr. Emmerson for the last two papers read. They were very valuable because they were practical. He must be allowed, however, to say that he was very much inclined to attribute a large portion of the unaccounted-for gas rather to the want of efficient inspection or correct measurement than to the leakage from even bad joints and imperfect workmanship. There was not the slightest doubt that the greatest possible care, and the adoption of all the suggestions offered by Mr. Emmerson were desirable, but, after all, they were not sufficient. If the smallest escape of gas took place in a room it rendered the place almost uninhabitable—an escape which did not bear the proportion of one five hundredth of the actual consumption on the premises—and the result was the evil was immediately rectified. So would it be in the streets, so that he did not believe the evil with which they had to contend arose from leakage absolutely as from the want of inspection, careful measurement, and the avoidance of stealage. He remembered many years ago that when he visited Scotland with the late Mr. Lowe they came upon a town, in the gas-works of which every foot of gas manufactured was accounted for. It was scarcely necessary to say that the manager was a careful man—and a Scotchman. Coming to England, Mr. Lowe told him of a case in which every foot of the gas manufactured was absolutely paid for. Why? Because the manager made every policeman an inspector. Again, he (the president) remembered on one occasion making an experiment, which no doubt some would think dangerous and improper, but then managers sometimes did things which were dangerous and improper without altogether considering what might occur. While engaged at the Brick Lane works, he one morning told the lamplighters to be about an hour later than the usual time in turning off the public lamps. Half an hour before the sun rose he had the whole of the gas turned off at the works for about five minutes. It was then suddenly turned on. The idea he had was that those who were using gas for private consumption would immediately detect the escape, and turn off their burners, the public lights remaining open. He then took the leakage, and found that the whole of the gas going along the main was accounted for by the public lamps then on but not lighted. With this experience in his mind, he would say that it was more to inspection and care in the measurement of the gas that they must look than to any other source. Mr. Emmerson had referred to condensation. It was quite true that one degree of temperature increased the dimensions or volume of gas by one 480th part, but it must be remembered that even when gas was measured at a high temperature it could not be much higher than the temperature of the atmosphere, therefore they could not look to any great extent for a remedy in this direction.

Mr. CRAVEN (Dewsbury) was rather inclined to attach importance to the remarks of Mr. Emmerson than to the registration to which the president had referred. At his works they were using the same means of registration they had heretofore adopted; but special attention had recently been given by him to the various matters alluded to by the writer, and during the last six years his leakage had been decreased from 28 to a little over 14 per cent. This was a pretty clear indication that in this direction they must look for the means of diminished leakage. One point to which Mr. Emmerson referred he thought was of some importance. He had always made it a rule when laying down new mains to take up the old mains. The neglect to do this was sometimes a prolific source of leakage. Another essential consideration was to have plenty of covering for the service-pipes and mains, so that they could not be easily deranged. Attention to these points would benefit many gas managers. In one other matter considerable improvement might be effected, and that was by the introduction of governors to street-lamps. Hitherto, in his town, the relations between the corporation and the gas company had been very agreeable, and the latter were unwilling to disturb them by adopting street

governors. But now that the works had passed into the hands of the corporation they would no doubt be introduced, and probably the leakage might be reduced from 14 to 10 per cent.

Mr. WATSON (Sydenham) was sure that every one present had listened with much interest to the papers read. The subjects discussed involved matters of no little importance to gas companies, and for himself he felt confident that he stood second to none in the room for the efforts he had made in years past to effect a reduction in leakage. In the company which he had the honour to represent (the Crystal Palace District Gas Company) the leakage was under 9 per cent., which was certainly to be considered a satisfactory state of things. He thought they were perhaps too apt to underrate the importance of little things in connexion with this question, and yet the reduction of leakage depended very much upon them. They knew all about the value of properly laid services, the employment of competent men, the tarring of the pipes, &c., but he was afraid sufficient attention was not always given to the bi-quarterly inspection of meters. If this were done, and a little more time was bestowed upon street regulators and public lamps, a serious source of unaccounted-for gas would be discovered, and might be effectually dealt with.

Mr. DOUGLAS (Waltham Cross) said that having had considerable experience in street-mains he did not believe very much in the supposed loss from condensation. He had tried it for a year or two on a 20-inch main, and the condensation was by no means great. The temperature of the gas was 45° when it entered, and it continued pretty much at that in the pipe. He never found it at less than 40°. For his own part he did not think there was very much condensation after manufacture. He had filled a gasholder and let it stand for a week without any great alteration. People sometimes said that the gas in the upper part was not so good, and that the holders ought to be emptied frequently. All he could say was he had never found it so. He believed the question of pressure was a very great point, and that there should never be more than two inches on the works. Whenever that was insufficient the pipes should be made larger. He did not attach much value to the use of street governors. Have the mains large enough, and the largest mains next the works, and there would be no trouble with them. Small pipes were the very ruination of a company. As to the inspection of meters, his experience in London had shown him the necessity and importance of this matter, and that it was a profit to a company to put in large meters. At one time he was connected with a company—a small company with about 1000 meters—and he advised the directors to put in new meters. As they were not very willing to do so he told them that if they would give him all the gas paid for over and above that which the existing meters registered for two years, he would pay for the new meters himself. They agreed to do so, but at the end of the first year they said they would rather not keep to their bargain. As to service-pipes, having laid miles of them in London, he did not believe much in leakage from that source. He had never found it very much, but he quite concurred in the remark just made as to the policy of taking up old mains when new mains were laid. Some people were apt to steal gas, especially when there were competing companies, and one way to prevent that was to take up old mains.

Mr. JABEZ CHURCH said he thought the first element to be considered in this question was to have their mains properly constructed and laid, for without that, whatever else was done, they could not effect the object desired. In one particular, which had come under his notice, he thought mains were often laid not sufficiently deep. No main, however small, should, in his opinion, be laid at less than 18 inches from the surface of the road to the top of the pipe as a minimum; for this reason—when they got down two feet the range of temperature to which the pipes were subject in this country did not affect the metal, consequently there was an avoidance of expansion and contraction, so that whether they used turned and bored, or any other kind of joints, there would be a less amount of leakage. An excellent plan to be adopted was to test the mains as laid down at five times the pressure under which they would ordinarily be worked. The slightest pin-hole would be detected in that way. Care in this respect had an excellent effect upon the workmen in making them more vigilant. Main-laying involved a great deal of care and attention, and even men who were frequently employed at it often made inferior work. Another element for consideration was the size of the pipes. No doubt, in the case of small pipes, when the velocity was increased in passing large quantities of gas through them, there was considerable loss, and condensation came into play more than under any other circumstance. But they could not dismiss from their minds the conviction that with every consideration and most careful inspection there was an enormous amount of waste from the mains and services. It was only necessary to see a street opened in London to be convinced of this, for often it would be found that the ground was perfectly blackened with the gas that had escaped from the pipes. In many cases the gas permeated through the molecules of the iron pipes. He thought great attention ought to be paid to service-pipes, because, after all, a considerable amount of leakage did arise from them. If the service-pipes were well looked after a great source of leakage would be discovered, and if a careful revision was undertaken the leakage would sink to a minimum. In laying a main, as a rule he considered that 9 or 10 per cent. in modern works should be the normal amount of leakage; where it exceeded this he should pronounce the work as unskilfully performed. And this question of leakage was one of great importance to gas companies. In going to Parliament for an increase of capital, or a variety of purposes, this question was now-a-days fully discussed, and woe be to the company who neglected it, for if they showed a large amount of leakage it inevitably affected their interests so far as their parliamentary powers were concerned. In every point of view, therefore, it behoved gas engineers in construction and gas managers in management to give to this question all the care which it certainly deserved.

Mr. G. W. STEVENSON ventured to think that it would be a very happy day for gas companies when their experience corresponded with the friend referred to at Manchester, and they had no leakage and no unaccounted-for gas. It was a common saying that the profits of a gas company were made or lost in the retort-house. Others things being equal, that was true. There the raw material was turned into the manufactured article; but having got the manufactured article, the company wanted to deliver it all, or as nearly all as possible, to the consumer through his meter. The question was how that could best be done. He thought Mr. Emmerson had really touched all the points that were to be considered in the matter. First of all came large mains—well-laid mains—then good services and good meters; a well-considered system of distribution, and a careful supervision of the public lamps. All these things were to be taken into account, and when that was done no doubt the leakage in towns generally, and even in very irregularly built towns, might be brought within 10 per cent. His own experience went to this point. In 1856 he went to Halifax to take charge of the gas-works for the corporation of that town. The unaccounted-for gas was then close upon 30 per cent. He took the question of the distribution in hand at once, before remodelling the works, and within two years (although there was a variation of level within the limits of supply of over 600 feet) he brought down the leakage under 10 per cent. This was effected simply by the introduction of street governors. Mr. Douglas in his remarks intimated that he did not like them, but he (Mr. Stevenson) found them absolutely necessary in Halifax, for wet meters were in use in that town, and they used to blow the water out of the meters. He, therefore, laid a new system of pipeage, and introduced street governors, and nowhere in the town (with 60 or 80 miles of mains) was there a pressure of less than 1½ inch, or more than 2½ inches. What was the consequence? The corporation saved £3000 a year in leakage, and the leakage was under 10 per cent. Since then the district supplied had been very much extended, and a great many miles of new main laid, but he believed the leakage at the present time was under 9 per cent. In 1866 it was his ill-luck to oppose a company in Parliament whose leakage was what was called a normal leakage—about 14 per cent. The engineer of the company was asked in cross-examination, "Cannot you undertake to bring your leakage down to what Mr. Stevenson says it ought to be—viz., under 10 per cent.?" He said it might. He thought he was working well, but said it might. That company were in Parliament this year, and the unaccounted-for gas, through good management and by taking advantage of the summer season to district the town and supply gas through a meter to certain districts, and thus seeing where the unaccounted-for gas went to, had been brought down to between 8 and 9 per cent., almost exactly the quantity which Mr. Watson had given as the rate of his leakage;—and an admirably managed work was that of the Crystal Palace District Company. He would say to gas managers, "Don't begin with a small main and go up to a large one. Begin at the works with a proper sized main for the supply of your district. If one will not do, and if you have districts lying far apart, take as many mains out of your works as you require in the directions needed, but do see that they are large enough to do their work. And if you have a rising district, control the pressure by street governors, and in that way keep the gas back for the low districts, and give a fresh initial pressure for the upper districts. In that way keep down your pressure and your leakage." He was sure that next to making money in the retort-house there was money to be made in the streets. The unaccounted-for gas was a most serious thing with many companies. It was well known that the largest company in the world had a leakage of over 750 million cubic feet per annum, which represented no less than £60,000 a year. There was an income for a gas company! If the leakage of the Chartered Gas Company were reduced to 10 per cent., it would give them 4 or 5 per cent. dividend upon their share capital, and they might do it as easily as any of the members present were doing it in their works. Therefore, he repeated it, this was a most important question, and one which ought strenuously to be urged upon the attention of all gas managers. If they wished to increase the dividends for their shareholders and put themselves in a position to be able to reduce the price of gas to consumers, let them first of all look to their leakage.

Mr. PEEBLES (Edinburgh) would have gas managers adopt as a motto, "Beware of the Steam Roller," for it would be found after the roller was in use some time there would be an increased amount of leakage in the streets.

Mr. WATSON mentioned a case in which a 20-ton roller had been in use for a week, during which 30 or 40 pipes were broken by it. Each of these pipes was not more than 12 inches from the service.

Mr. BARRETT (Accrington) thought one point which deserved notice was this—when wet meters were very largely used there should be frequent inspection and proper attention to the watering of those meters. He had had considerable experience with regard to this matter, having had four works under his care. He undertook the charge of works, on one occasion, which the proprietors were about to sell, as they could not make them answer. Believing they might be made to pay 7 per cent. the first year, he accepted the management, agreeing to receive for his professional assistance all the profits beyond that amount. He found the inspector in that place not worth twopence, for it had been supposed that any man was capable of undertaking that office. By careful management he (Mr. Barrett) was able to make the works pay 10 per cent. at the end of 12 months. He held it to be essential that all inspectors, especially in the case where wet meters were in use, should have some mechanical knowledge as to the construction of those meters, or it was impossible for them to deal with them. It was no use for managers to exert their energies to get all the gas possible out of the coals, if a large quantity of this gas was to pass through the consumers meters unregistered.

Mr. TALLENTIRE (Lisburn) said some facts appeared to him to have been overlooked in the paper and in the discussion. No one had referred to the distance the gas had to travel, nor the pressure that must be maintained. In his case he had to supply mills at a distance of two miles and 2½ miles from the works, and from the time those mills lighted up till they ceased burning he was under the necessity of keeping up a 3-inch pressure on the mains. Two of these mills had gasholders of their own, and being situated so much below the gas-works, the 3-inch pressure was not sufficient, and they drew from him to fill their holders day and night; consequently his unaccounted-for gas for the last 12 months had been over 20 per cent. This pressure was kept on from the latter end of October to the middle of March. He had tested the length of the main at every two or three yards, and could find no leakage. If any one could show him how to reduce his unaccounted-for gas he would be glad.

Mr. BROADHEAD (Grimsby) said he had frequently read that the lowest estimate for unaccounted-for gas was 10 per cent., and the highest 20 to 30, and when he heard Mr. Watson say his leakage was about 8 per cent. he thought he must keep still. But after hearing the last speaker state that his leakage was 20 per cent., he felt he might venture a word. In his own case the leakage had been as low as 11; it had been as high as 16, and now it was 14 per cent. When it was at 11 per cent. he was making only 11 millions per annum, now he was making 50 millions. He had 2300 consumers and 300 public lamps to supply; 50 miles of mains from 12 inches down to 3 inches, and two-thirds of the soil in which they were laid was pretty good clay, while the other third was entirely sand from the sea, and of a character which quickly destroyed the services. After what he had heard, he should be inclined to put them in black coffins like Mr. Warner's. Having extensive docks to supply, which yielded a rental of £1400 a year, and where there was a good deal of night work carried on, he was required to keep up the pressure till 10 or 11 o'clock. In supplying the public lights he professed to give 5 cubic feet per lamp per hour; so that, perhaps, under all circumstances, his 14 per cent. unaccounted-for gas might be considered not an unreasonable thing.

Mr. DAVIS (Hereford) remarked that a good deal had been said with regard to leakage from mains and service-pipes. There could be no question, he thought, that this was a source of the evil, but by the improvements made of late years a great deal of this had been done away with. But there was one direction in which the unaccounted-for gas might be searched for successfully. In his city they had for many years been lighting the public lamps, numbering in all about 400, 91 of which were kept burning from sunset to sunrise, and the remaining portion only till midnight during the greater part of the year. Two years ago the corporation made an alteration in the lighting arrangements, and instead of lighting the last-named lamps till 12 o'clock only, they lighted the whole of the lamps all night, with the exception of June and July. The unaccounted-for gas formerly was rather over 18 per cent., but as the result of the first year's working of the new arrangement—without making any improvements in the mains, without laying any new services, or doing anything by which the previous loss might be expected to be reduced, with the exception of renewing a portion of the meters when the Sales of Gas Act came into force—the unaccounted-for gas was now brought down to a little over 11 per cent. There was no doubt in his mind that previously the lamps up to 11 or 12 o'clock at night were burning 7, 8, 10, and even 11 feet each per hour. He was perfectly well aware of the fact, and was repeatedly calling the attention of the directors to it, and pointing out the saving which would arise from affixing a governor to each lamp, but as the company were paying their full dividend—and a good dividend, too, of something like 20 per cent.—they did not see the necessity for expending £150 in altering their lamps. The corporation, of course, could not see the necessity. There was a proposition that if the Lighting Committee would bear one-half of the expense the company would pay the other, but this was never carried out. The works had now passed into the

hands of the corporation, and at the last meeting of the council, he (Mr. Davis) submitted a proposition, and the Lighting Committee were going to put governors to the lamps without making a charge upon the Gas Managing Committee for the same. When this was carried out he had no doubt that the unaccounted-for gas would be reduced to 10 per cent., and even less.

Mr. ELDRIDGE (Richmond) said he should like to ask Mr. Watson and Mr. Stevenson how they calculated the quantity of gas supplied to the public lamps—whether by meter or as a mere estimate. A great deal turned upon this, and he believed that the difference of anaccounted-for gas frequently arose in this way.

Mr. WATSON said the company used Sugg's regulators, for which they paid a certain price, and the manufacturer guaranteed their proper working order at 5 feet per hour.

The PRESIDENT: How do you know that it is 5 feet and not less or more?

Mr. WATSON: I take it for granted it it quite 5 feet, but I believe it is nearer 6.

The PRESIDENT: I think you may take that as a general rule.

Mr. STEVENSON: I am in a better position, and I shall have to name the company. It is the Brighton and Hove Company—one of the best managed in the kingdom. They supply gas to the public lamps by average meter registration, and the unaccounted-for gas, which was 14 odd per cent. in 1866, is now less than 9 per cent. At Halifax there is no regulator and no meter, and they burn 5, 6, 7, or 8 feet—anything you like.

Mr. CHURCH said, as he had made the same statement as to leakage, he might be also allowed to answer the question. He took it as a matter of fact that if a gas company contracted with a corporation or local authority to give them 5 feet per hour, they had no business to give them 6; but he looked upon unaccounted-for gas as being the difference between the gas registered at the station-meter and the amount brought into the revenue account. Therefore in estimating the unaccounted-for gas, he took the quantity at the station-meter, the quantity registered at the consumers meters and brought to book, and then the amount received for the public lamps less the charge for lighting, cleaning, &c., and saw how much that represented. He believe that was the true way of arriving at the correct commercial result.

The PRESIDENT: Do you mean to say you take the quantity consumed by the public lamps at 5 feet?

Mr. CHURCH: No; I take the quantity paid for, deducting the cost of lighting, &c., and I say the balance represents so many thousand feet at the price at which the gas is supplied.

Mr. METHVEN said at Sudbury, which was supplied from works belonging to him, he had adopted the average meter system. He also used Sugg's regulators, adapted for a consumption of 4 feet per hour. His manager told him that the actual consumption was a little more than 4½ feet per hour.

Mr. G. ANDERSON said he had heard so much that was so generally known that he felt he had gained little information on the subject after all the conversation that had taken place. The paper read by Mr. Emmerson related to a subject of the first importance, and he appeared to have said almost all that could be said about it, but all the subsequent talk about per centages was what the Americans called "bosh." And he would give his proof of it. Their friend from Leeds—or rather the friend who always wanted to be going there—stated that a few years ago his unaccounted-for gas was 14 per cent., and that now it had got down to 11 per cent. But what were the facts? When his leakage was 14 per cent. he was making 11 million feet of gas, so that his leakage amounted to 1,540,000 per annum; now that he was making 50 millions of gas his leakage was only 11 per cent. But what was 11 per cent.? 5,500,000; *ergo*, he was losing about four times as much gas now as he used to do, notwithstanding the per centage was smaller. Now, he called attention to this matter because he was entirely opposed on principle to a course which was very much adopted in the present day. An unfortunate company went to Parliament, and up started some one immediately to state how much better he could carry on their business than the company had done. It was utterly unfair to the company to talk about what they ought to have done, as though they had been supplying a brand new district with new works on the most improved principles. This was the basis on which all such high-flown calculations were based, and he contended that it was impossible for those who had charge of works 40 or 50 years old, in towns where, perhaps, other works had been swallowed up and absorbed, so that no one knew exactly how and where the mains were laid, to carry on their operations with these theoretical per centages. What would be bad working with 10 per cent. leakage in one case would be good working and consistent with efficient management at 20 per cent. in another. He was as much interested in attaining a low rate as any one, because he was the lessee of many works; but, as a matter of fact, he knew that the leakage in some was double what it was in others. He did his best to district his mains, put on meters, check the consumption of the public lamps, and take every other means indicated. Yet, notwithstanding all, he found it impossible in some places to reduce the leakage to what he should like it to be. Some of the members of the association had to supply mining districts where there were miles of galleries stretched below them, and where, from constant subsidences, mains were always leaking. Others were supplying close to the sea, where there was nothing solid, and others in manufacturing districts, where soda and acids were made, which percolated the soil, oxidized the pipes, and soon made them leaky. In all cases circumstances must be taken into account, and he protested against the general statements being made about per centages as though any fixed rule could be adopted. It wa all nonsense.

Mr. MARTIN (Ormskirk) said in the last three years his consumption had decreased materially, and so also had his unaccounted-for gas. He attributed this chiefly to two causes, one was the laying of larger mains, and the other the putting down of three separate mains from the works with three separate governors. Although his delivery was small—under 12 millions—he thought it expedient to have three governors, and he attributed the smallness of his leakage very much to that fact. Another remedial measure was the watering of the meters oftener than before. While the sale of gas had decreased in his town, and the capital had been augmented, the balance of revenue had increased.

The PRESIDENT: What is your leakage now?

Mr. MARTIN: 7½ per cent.; it was 35 per cent. before.

Mr. TALLENTIRE said he had observed from the remarks made, that there was a great difference in the mode of taking the unaccounted-for gas. He lighted by average meter indication, and took the consumption at the meters, and what was paid for public lights; other gentlemen did not do so.

The PRESIDENT remarked that there were, no doubt, various ways in which leakage was calculated, but by a comparison of the facts stated, the results in all cases could be ascertained. The general mode was to take the quantity of gas registered at the station-meter, and from that deduct the quantity used on the works; the quantity registered at the consumers meters, and the quantity consumed by the public lamps (which he always calculated as 4000 hours, at 5 feet per hour each).

Mr. THOMAS (Alton) thought a portion of unaccounted-for gas might be traced to the settling of pipes. Sometimes in laying mains the trenches were dug too deep in parts, and stones were put under the pipes, which when the ground was rammed in were sure to sink. Other sources of evil were that meters were sometimes not fixed level, and dry meters not tested often enough.

Mr. GIBB traced a good deal of the evil to not having a proper register of services and an acquaintance with the soil in which they were laid. Defective services were a great source of loss.

Mr. WARNER (South Shields) said if this discussion had taken place some few years since the one great and important question debated would have been that of meters. It would have been a battle of the Wets and the Drys. He was very happy to say that that had entirely passed away, because it convinced him that managers generally were thoroughly assured that in well-constructed meters, whether wet or dry, they had now a perfect measure of the gas they supplied. To his mind this was a very pleasing state of things. With regard to the general discussion, while he regarded it as upon the whole satisfactory, he thought there had been some little mistakes. On the question of mains, new ones had been spoken of, and the manner of laying, and there was evidently a tendency to treat a town as a new district to be lighted instead of taking it as lighted, and to be dealt with accordingly as a whole. As to leaky mains, only during the previous week he was putting down a new 10-inch main. He cut off a portion of the district, and before the new main was connected he had the district tried. They were registering through a small meter for the purpose with 15-10ths pressure, and he found they were losing some 90 feet of gas an hour. He then had several streets cut off, and brought down the loss to 8 or 10 feet. He had the services relaid, but it seemed to make no difference. He then had the main stripped, and found that two of the joints had drawn. The loss was then about 1 foot per minute on the section under test, and this was brought down to 1-10th. As to services, he believed lead was not the material for this purpose. The iron tubing boxed in with tar and sawdust, as in the model before the meeting, aptly described by Mr. Broadhead as his (Mr. Warner's) coffin, was the only effectual method of preventing leaky services. Unaccounted-for gas, however, did not arise from either meter, main, or service alone, or the whole together, but from the want of a more thorough system and much greater attention than had been paid to the whole of this important matter of distribution.

Mr. EMMERSON briefly replied, and expressed his satisfaction at the practical character of the discussion which had taken place on his paper.

On the motion of the PRESIDENT, thanks were voted to Mr. Warner and to Mr. Emmerson for their papers.

Mr. GREEN (Dartford) read the following paper:—

ON STOPPAGES IN ASCENSION-PIPES.

With your kind permission, I will endeavour, without encroaching upon your valuable time in a lengthy preamble, to place before you what appears to me a remedy that will materially assist, if not entirely prevent, the trouble and annoyance of choked ascension-pipes.

Most of us are too well acquainted with the demand upon our time and patience, besides the nuisance and cost frequently occasioned by what is called by our stokers "blocked pipes." Many and various have been the suggestions, and even patents brought to bear upon this important matter, with what effect, so far as practically removing the evil, you can best judge. It is not for me to presume showing you over ground well known to you all; but from what I have ascertained at the small works I have charge of, and from the printed reports that have come to my notice, I am constrained to think we have not been looking quite in the right direction to find a remedy—viz., at the size of ascension-pipes, their heat, &c. From what has presented itself to me latterly, I think with the gentleman who spoke upon the subject at our last meeting—that the pipes might be twice the ordinary size, and he may have said as cool as you please. It would then, even under these circumstances, only be a question of time.

Now it is well known that to carbonize with high heats we are sure of having some choked ascension-pipes, and that it never occurs with low heats without there is some defect in the pipe itself. This plainly points out that the heat of the retorts is the chief contributor to stopped pipes. Turning this matter over in my mind, I thought if it were possible to intercept the flow from the retort before it gained access to the ascension-pipe, probably some of the substance that caused this intolerable nuisance might be arrested, and an opportunity afforded of scrutinizing this our common enemy, and see what it was really made of. With this view, I constructed a guard with shelves, and placed it into the mouthpiece of a retort after it had been charged with the usual quantity of Newcastle coal. This retort was the best heat of any in the set, and the ascension-pipe was constantly choking up. It being necessary to remove the lid, at least twice during the process of carbonizing an ordinary charge to clear the obstruction. The lid of the retort was then secured, and instructions given that if anything went wrong with that particular retort, the stoker should come to me. I saw no more of the retort or the stoker until the usual time of charging had come again, when I was pleased to know that it had not been necessary to remove the lid during the whole time that charge had been working off. The lid was then removed, and the guard withdrawn, upon the shelves of which was deposited something which I now show to you, and which would, no doubt, have choked the ascension-pipe. The same guard is now regularly placed into that retort, with the same beneficial results. It was made of common plate-iron, about ¼-inch thick, with a loop upon the front to admit the point of an ordinary small rake, by which it can be quickly taken out or replaced when required.

Shortly after this, in another set, we had a pipe leading from a very hot retort, so choked that nothing could be got through. The pipe was therefore disconnected and another put in its place. It was fixed and ready for work before the man could complete the guard; but so convinced was I that *this pipe* would choke up like the previous one without it was guarded, that I had the guard placed into the retort unfinished (without the shelves). Nothing more has been done to that guard, and the ascension-pipe has not been choked since; in fact, with our guards, we are now the masters instead of slaves to ascension-pipes as heretofore. But, as prevention is better than cure, I would advise the use of such a guard before the pipes become choked. Since then other guards have been constructed similar to that in sketch No. 3; being convinced that the previous ones were a step in the right direction, and they have stood the severest tests possible.

And now, gentlemen, after the remedy has been pointed out to you, the cause of choked ascension-pipes must be left to your individual opinions, which I do not pretend to combat here. My opinion, however, is that they are produced in this way. The higher we get the heats in the retorts, the more cessible become particles of disintegrated carbon and other dry substances which are continually being made and drop from the inside of the retort, and these are the very particles that have been caught upon the shelves of my guard. They are swept off, mingle with, and are carried along by the crude gas, which is being rapidly produced by great heat from the coal in the retort, and meeting the tar that slowly flows down the sides of the ascension-pipe, when near the entrance, becomes so thickened with this continuous process, that a substance is quickly formed which ultimately chokes the pipe.

I think there may be other advantages gained by using this guard. Frequent complaints are made of accumulations of a thick substance forming in hydraulic mains, which, in spite of many contrivances, adds to the pressure upon the retorts. Probably this is caused by a quantity of minute particles of finely divided carbon or other substances being driven by excessive heat from the retort, and from their lightness succeed in reaching the dip-pipe, and then becoming deposited in the hydraulic main, are the cause of increased pressure through the opposition they offer to displacement.

Other ideas have presented themselves, which induce me to attach a future importance to the guard I have had the honour to explain; but as time and other circumstances have not permitted me to complete my investigation, I prefer withholding the result until I shall be in a position to place them before you with greater confidence.

The PRESIDENT asked Mr. Green how long his contrivance had been in use.

Mr. GREEN: About two months.

The PRESIDENT: You would be worth your weight in gold if you could effectually get rid of stopped pipes.

The SECRETARY read the following paper by Mr. W. Parlby (Aylesbury) on the same subject:—

Among the many operations almost incessantly going on in a gas-works, it is not to be wondered at that here and there difficulties arise which require much ingenuity and skill to surmount. Of these difficulties, perhaps none have been more frequent in their occurrence and perplexing in their character than the stoppage of ascension-pipes. This evil has existed from the early days of gas manufacture, and, notwithstanding the attention which engineers have so long devoted with the view of removing it, there is as yet no generally acknowledged plan whereby such stoppages may be prevented.

Various suggestions, more or less valuable, have from time to time been made, but the question still remains open for solution—How can stoppages in the ascension-pipes of gas-retorts be prevented? Desirous of settling this question, our committee have again, in their syllabus of subjects, brought the matter under the notice of the members; and, in sympathy with that desire, the writer has attempted to put together a few practical suggestions, which, with the discussion of the meeting, it is hoped will prove a means of clearing up the difficulty. I would, however, observe that a very useful and valuable paper on this subject was read before the association in Dublin in 1871, by Mr. Somerville, on which occasion it was not my privilege to be present. The only reason I have for bringing the subject again before the members is the importance which we all attach to it.

That the question may be systematically and practically solved, we cannot proceed in a better way than by inquiring—

Firstly—Whence such stoppages arise, and

Secondly—Ascertain how they may be avoided.

Firstly—Whence such stoppages arise. Chemical science has demonstrated that the formation of carbon in the retorts is occasioned by the very high temperature necessary to effect the proper carbonization of the coal, under which circumstances a portion of the evolved hydrocarbons is decomposed. The gases given off in the distillation of the coal become further acted upon by the greatly reduced temperature of the ascension-pipes, in the interior of which, as we all know (after the pipes have been in use a short time), a carbonaceous deposit, somewhat analogous to pitch, is frequently to be found. To this settlement in the pipes is attributed the cause of stoppages.

If the gas could always with safety be drawn away immediately it is generated from the coal, the formation of carbon in the retorts would probably never trouble us; but, as this is generally impracticable in ordinary working with the apparatus now in vogue, a portion of the gas necessarily undergoes decomposition, notwithstanding the benefits realized by the exhauster. This carbonaceous settlement in the pipes is a somewhat different modification to that formed in the retort, and may be considered as partly the result of chemical and partly that of mechanical action to which the gases are exposed at varying temperatures. To what circumstances, then, are to be traced the stoppages of ascension-pipes.

1. The heat given out from the coke left behind after the gas has been generated from the charge of coal in the retort converts the tarry deposit in the pipes into a substance very much resembling pitch, which, in the course of time, prevents the passage of the gas. This fact is observable if a setting of retorts is allowed to lie idle beyond the time necessary to work off the charge. The tar accumulated on the sides of the ascension-pipes becoming exposed to the higher temperature of the incandescent coke is deprived of its more volatile constituents, leaving a dense spongy incrustation around the lower part of the pipes and the top of the mouthpieces, which, unless completely removed before the retorts are recharged, will speedily choke up the pipes.

2. A large seal of the dip-pipe acts exceedingly prejudicially to the flow of the gas, fosters the formation of carbonaceous matter in the ascension-pipes and retorts, thereby considerably diminishing both the quantity and quality of the gas produced.

3. Any flaw or defect in the casting of the pipes, and any impediment arising from irregularities in the joints in the interior, present a means at once favourable for the formation and settlement of deposit. This there can be no doubt is an important point in the question of stoppages.

4. Every facility for the choking of the pipes is afforded when their capacity and the hydraulic main is inadequate for carrying off the gas.

These four reasons explanatory of the occasion of stoppages have not hurriedly been arrived at, but are the result of a careful and minute investigation. They may not embrace all that is associated with the cause or causes of stoppages, but they reduce the question to a more definite form, and bring its solution within the reach of every gas manager.

We have now, *secondly, to ascertain how such stoppages may be avoided.*

It will be clear it is of the greatest importance that the outlet of the mouthpiece should be sufficiently large as to permit of the unobstructed passage of the gas during the carbonization of the coal; otherwise, as we have before shown, the crude gaseous products emitted during the distillation will remain exposed to the action of the heat, and by their partial decomposition will leave their incrustations of carbon or pitch around the orifice of the mouthpiece, and ultimately stop up the gas way.

It is also important that the ascension, bridge, and dip-pipes be large enough to carry off without obstruction the products of distillation, which for retorts of the ordinary size should certainly not be less than five or six inches in diameter internal measurement, and with as few angles and joints as practicable.

Particular care should also be taken in the moulding and casting of the pipes and in the making of the joints so as to avoid irregular surfaces in the interior.

Another important point to be observed in order to secure the ascension-pipes from gathering deposit is the employment of a proper seal for the dip-pipe in the hydraulic main. If it exceeds ¾ of an inch in depth, there is but little doubt that the gaseous products of the coal will continue too long in contact with the pipe, and produce a tarry deposit therein. The manufacturer will also be deprived of a large quantity of the richer hydrocarbons, whilst the action of the retorts and pipes is seriously impeded.

Special attention should also be paid to the size of the hydraulic main, and the outlet for the gas and liquid, and the capacity should be such as to afford the easy passage thereof.

From these considerations it will appear that the stoppage of ascension-pipes is fostered under various circumstances, sometimes by a defective mouthpiece, sometimes by small, irregular pipes and bad joints, sometimes by a contracted main and large seal of the dip-pipe.

In studying to avoid stoppages, we cannot be too careful in the attention required by these points of detail to which I have adverted. The application, however, of improvements in these respects, though absolutely essential if we would obtain the most satisfactory results, will not furnish us with the means whereby stoppages may be altogether avoided. The secret of success, I believe to be in the hands of the stokers, providing there exists suitable and well-arranged apparatus. Let them be required to attend to the following instructions, viz.:—

1. The temperature of the retorts to be maintained at a uniform degree—say a good white heat.

2. The mouthpiece to be kept clear of carbonaceous and tarry matter as much as possible.

3. Whenever a charge of coals is worked off, and the retorts are not wanted for immediate use, let all the lids be slightly unfastened, or the heat from the coke will congeal the tar in the ascension-pipe, converting it into pitch, thereby preventing the passage of the gas.

4. The hottest retorts to be charged heavier proportionately to the others, that the charges may be worked off in the same length of time.

Since writing the above, the writer has had his attention directed to an improvement recently introduced by Mr. Malam, of the Dumfries Gas-Works, by which the choking of the ascension-pipes is said to be prevented. The improvement consists in causing a small stream of water to enter the ascension-pipe at the top, which, being delivered in a thin spray, diffuses itself in the interior of the pipe, keeping it cool, and preventing deposit. An account of this improvement is given in the JOURNAL OF GAS LIGHTING, of April 13, 1873.

In conclusion, permit me to add that it is with some degree of reluctance I have been induced to lay these observations before you, but in reliance upon that forbearance and co-operation which the members on every occasion have accorded the writers of papers, I leave them in your hands.

The PRESIDENT said he could not conceive anything more annoying than the visit of a plague of stopped pipes to a manager. Nothing could be more depressing to him, and nothing more serious for the works. In the first place, it wearied the men, who had to use sledge hammers to clear the pipes; it destroyed the retorts, for they would not last half their time. Of course, as was to be expected, any general evil such as stopped pipes was sure to have many remedies suggested; but, after all, he was inclined to think it depended very largely upon the quantity and kind of coal used. He remembered very well that when he entered into the service of the Chartered Company their dip-pipes were only 2½ inches. He did not know what would be thought of an engineer now-a-days who had only 2½ inches. He remembered that he altered the pipes by putting in pieces of tin just underneath the flange upon the hydraulic main, by which means he increased the 2½ inches by the thickness of the cast iron; but this he noticed, that when they were using a particular kind of coal, with ordinary care on the part of the stokers, they had no stopped pipes. The moment they changed to another kind of coal the plague was upon them. They tried water in the mouthpiece, putting in small dishes of water, so that it might evaporate and so the steam loosen and prevent the filling up of the pipes; but the end of it all was that whenever they used this coal there was sure to be stopped pipes. All he could do was to say to the men, "Be particularly careful in augering the retort-pipes, and keep them thoroughly clear every time the retorts are drawn." He must confess that the suggestion thrown out by Mr. Green appeared to him a very reasonable one. Stopped pipes occurred through the volatilization of dry particles of carbon, which seemed to sublime up and settle in the pipes, and it seemed to him very likely that the screen which Mr. Green proposed to put in might prevent these dry particles ascending. If the contrivance did succeed, it would be a most valuable invention, and prove of the greatest consequence to gas companies and managers. It was for that reason he asked Mr. Green what experience he had had with it. One would like to hear that it had been in use two years, and not two months only. It certainly bade fair to be of some service.

Mr. CHURCH asked whether the screen was the whole width of the retort, and how it was fastened in.

Mr. GREEN replied by producing a model of a retort mouthpiece, fitted with screens, which showed them fitting the sides and top of the mouthpiece, but having a space at bottom to allow the gas to pass through on its way to the ascension-pipe.

The PRESIDENT said it was simply put into the retort between the coals and the ascension-pipe.

Mr. DOUGLAS said for many years he had not had stopped pipes, because he made his ascension-pipe six inches. But with some kinds of coal he believed stoppages would occur in any pipes. He had an idea that the invention just introduced to their notice might answer the purpose intended.

Mr. BARTHOLOMEW (Glasgow) asked what the screen was composed of.

The PRESIDENT: Sheet iron.

Mr. BARTHOLOMEW doubted, if that were the case, whether it would continue long in shape.

The PRESIDENT said it was placed in the cool of the retort—merely in the mouthpiece.

Mr. BARTHOLOMEW still expressed doubt whether it would maintain its form.

Mr. GREEN: The one we have used for two months keeps its form, and is not bent or out of shape in any way.

Mr. BARTHOLOMEW: It will depend very much upon the temperature of the retort. In my experience I have never had stopped pipes except with high heats.

Mr. WARNER: May I ask whether, when using the coals to which the president referred, where stopped pipes occurred, greater heats might not have been used, or whether, in his opinion, the evil arose entirely from the coal.

The PRESIDENT: The experience I have is this, that with retorts at the same temperature, worked identically in the same way, we never had stopped pipes while using one kind, and that with the same retorts, at the same temperature, with the other coal, we invariably had them.

Mr. PATERSON (Warrington) said he thought the chairman had indicated clearly the direction in which to look. There was no doubt at all that, under the influence of temperature, coals were very differently affected. He had himself frequently found no difficulty with one kind, while with another description, at the same temperature, he had suffered from the evil complained of. To meet this evil he had enlarged the diameter of his pipes, and had put them in from 6 up to 9 inches, and even in this largest size he had had stoppages. He thought the design submitted by Mr. Green might prove beneficial.

Mr. EMMERSON said the subject of stopped pipes was a great difficulty to him last winter. It had been remarked that increasing the bore of the pipe would be some mitigation of the evil; but he might state that at the last works he had in charge, which were smaller than his present works, he never knew what a choked pipe was. At present he was scarcely 24 hours without one. It struck him that it was more a question of temperature than size of pipe, and that if something like a tuyere coil could be jacketed in the ascension-pipe, and a continuous stream of water made to trickle down it, they might get over the evil.

Mr. WATSON said the best plan was to keep the ascension-pipes as far away from the brickwork as possible. If they were kept cool there would be no difficulty with stopped pipes. He found that whenever he used coal which had been kept out of doors two or three months there was an immediate tendency to stoppages.

The thanks of the association having been voted to Mr. Green and Mr. Parlby, the sitting closed.

In the evening, as mentioned in our last, a *conversazione* was given in the Museum; and at eight o'clock the following lecture was delivered in the lecture-hall of that building:—

ON THE PHYSICO-CHEMICAL PROPERTIES OF GASES.

By Dr. STEVENSON MACADAM, F.R.S.E., F.C.S., &c.

Ladies and Gentlemen,—When the committee of the Association of Gas Managers asked me to lecture this evening, I thought it would be better to take up a subject which might not be regarded as strictly within the beaten track of other discourses delivered by previous lecturers before the association. Consequently, as many questions connected with the manufacture and purification of coal gas, and likewise the methods of burning it with the greatest possible efficiency, had been fully discussed at meetings in the South by Dr. Letheby and Dr. Odling, as also at previous meetings in the North by Dr. Wallace and myself, it appeared to me desirable that we should to-night take up some of those peculiar properties of gases which may be regarded as bordering upon pure chemistry and pure physics—in other words, that we should take up some of those subjects which may be spoken of under the general term of the physico-chemical relations of gases—rather, I may say, an out-of-the-way term, and one which might almost be assumed to involve a good deal of strictly scientific knowledge and a good deal of prior information on the subject. But I will endeavour, with certain experimental illustrations, and by ridding my remarks of scientific language as much as possible, to make the subject not only interesting, but I hope also instructive to every one present.

Now, in the first place, we will direct our attention especially to those relations between one gas and another which are concerned with the weights of the gases; then, after that, of the solution of the gases in certain materials; after that, to what is sometimes looked upon as a very abstruse subject, the diffusion of gases, and also to another department—viz., the dialysis of gases. I hope all these are terms which will become familiar to you as I proceed.

The very nature of coal gas demands that we should consider the gases pretty much as a large class of bodies—because coal gas is not a single gas. It consists of a great many gaseous bodies—a kind of mechanical mixture of gases, similar to that obtained in solids where particles of coal and sand and other materials are all rubbed up together. In fact when you come to consider the chemistry of coal gas, you will find that even taking the shortest account of it, you have a large number of gaseous bodies present. Those are given on the table I have here:—

Coal.—Destructive Distillation—Gaseous Products after Separation of the Aqueous Fluid and Tar.

Hydrogen	H
Light carburetted hydrogen	CH_4
Heavy " "	CH_2
Volatile hydrocarbon	C_nH_n
Benzol	C_6H_6
Carbonic oxide	CO
Cyanogen	CN
Hydrosulphuric acid	H_2S
Ammonia	NH_3
Carbonic acid	CO_2
Sulphurous acid	SO_2
Bisulphide of Carbon	CS_2
Nitrogen	N

Some of these constituents are extremely useful for giving us light, others are not of so much value for that purpose, whilst some are prejudical to the illuminating power of the gas. And we must remember that this list does not take into consideration a whole series of substances which can be condensed from the crude gas, and which we call condensible products. These are given in the following table:—

Coal.—Destructive Distillation—Condensible Products.

Aqueous vapour, water holding in solution	Ammonic carbonate.	
	" sulphate.	
	" sulphide.	
	" chloride.	
	" ferrocyanide.	
Oily Vapours.		
Liquid	Bensol C_6H_6	Naphtha.
	Toluol C_7H_8	
	Cumol C_9H_{12}	
Liquid	Anilin C_6H_7N	
	Picolin C_6H_7N	
	Leucolin C_9H_7N	
	Phenyl C_6H_6O	Heavy oil of tar.
Solid	Naphthalin $C_{10}H_8$	
	Paranaphthalin $C_{14}H_{10}$	
	Pyren $C_{12}H_{12}$	
	Chrysen $C_{21}H_{14}$	

But taking coal gas, as we obtain it, at an ordinary gas-jet, we have, not a single thing, but a mixture of a great many gases, all possessing chemical properties more or less distinct from each other, and having different weights, or, as we call them, specific gravities.

Now I have a table here which gives the names of some of the principal gases and vapours which are known to us in chemistry, and which also states their respective weights or densities:—

Gases and Vapours.—Specific Gravity or Density.
Air = 1·000.

Hydrogen	0·0692
Marsh gas	0·559
Ammonia	0·590
Steam	0·6235
Carbonic oxide	0·967
Nitrogen	0·971
Olefiant gas	0·978
Nitric oxide	1·039
Oxygen	1·1056
Trihydric phosphide	1·185
Dihydric sulphide (hydrosulphuric acid)	1·191
Hydric chloride	1·247
Nitrous oxide	1·527
Carbonic anhydride (carbonic acid)	1·529
Sulphur	2·230
Sulphurous anhydride (sulphurous acid)	2·247
Chlorine	2·470
Phosphorus	4·420
Bromine	5·540
Mercury vapour	6·976
Iodine "	8·716
Arsenic "	10·600

We generally have a notion that gases are all extremely light, and that they pretty much resemble each other in their general appearance. Take such a one as I have here in this jar. It appears, no doubt, to you as though the jar was wholly filled with air; but I may tell you that it is so different from air that it is 14½ times lighter than air, so that if I could get this jar filled with air and the contents weighed 14½ grains, and we then filled it with hydrogen, the gaseous contents would only weigh one grain.

Here is another gas, carbonic acid, which I have prepared from marble by adding to it some hydric chloride acid. This gas is quite similar in appearance to the hydrogen which we had in the other jar, and yet it is 22 times heavier. In fact, the gas which we have in the first jar, and which is the gas that stands first on the table of gases and vapours—hydrogen—is a gas which must be retained in a vessel closely covered up; and if we take this jar from the tray in which it stands, and hold it up a moment with the closed end of the jar uppermost, so that the gas cannot escape at the top, notwithstanding the mouth of the jar being open, the gas remains in the vessel on account of its great lightness. If this were a balloon, it would buoy it up. That the gas still remains in the jar you will see when I apply a light to the lower part. It burns with a sudden flame.

Then again, if I take another jar of the same gas, and instead of opening the vessel with its mouth downwards I open it with its mouth upwards, you will find that the gas begins to rise and to escape into the air. If I now take a taper, and introduce it into the vessel, you see I have to go down and down searching for the gas, and put the taper to the bottom of the jar without obtaining a rush of flame—in fact, the gas has practically escaped from the jar into the air.

But there are other ways of showing somewhat the same thing. I take another vessel containing hydrogen, which, as we saw, is so light that it keeps in the upper part of the vessel, and I take this glass pail, which at present contains nothing that will take fire—in fact, has simply air in it—and pass it up into this vessel containing the gas. I take it away and find that the comparatively heavy air that was in the glass pail has fallen out of it, and the light hydrogen, which was in the larger jar, has risen into the pail and taken the place of the air. We can now fire the contents of the small glass pail. We can take the little pail once again and put it up into the larger jar, and time after time we get a combustible and explosive mixture, which fires at the approach of a light. This shows without doubt the extreme lightness of this particular gas called hydrogen.

But then, again, we have another illustration of it in this small balloon, which is filled with hydrogen. The escape of the balloon into the air, when we release our hold of it, shows how much lighter hydrogen is than atmospheric air.

Yet another way of noticing the same thing. We can show the lightness of this gas by actually weighing it against ordinary air. I take here a portion of the hydrogen gas and put it into a small bell jar which we suspend beneath this beam, and when the gas is allowed to rise up into the bell jar the end of the beam rises, showing that the bell jar when filled with hydrogen is not so heavy as when filled with ordinary air. But a better way of noticing the lightness of this gas is to compare its density with that of a heavier gas.

For instance, I take the gas which has been prepared from marble and carry it to this part of the table, where I shall endeavour to find out whether it has any property which will show itself. This gas, instead of possessing a lighting power, has the power of extinguishing light, which can be observed by simply placing a lighted candle in the jar, when it is immediately extinguished. But another property of this carbonic acid gas is its great density. If we take this vessel, which is filled with the gas, and pour the contents over this lighted candle, it at once extinguishes the flame. We will now place a lighted candle in this other glass vessel which contains ordinary air, and proceed to pour in some of our heavy gas. What is the effect? You see the gas falls down and the candle is extinguished.

This is one of the gases which, compared with air—ordinary atmospheric air—we call a heavy gas, and we can show its heaviness in various other ways. One method is to try and pass it into this glass vessel suspended to the beam of the balance, and as we pour it in the particles of the heavy carbonic acid gas fall down, and the vessel with its contents then become heavier than when air was alone present, so that the balance-beam is depressed at that side.

One very striking way of noticing the weight of a gas may be observed in this manner. We have here a gas—chlorine—which is a good deal heavier than the heavier of the two gases I last worked with. Carbonic acid is 22 times heavier than hydrogen—chlorine is about 36 times heavier. I shall endeavour to show its weight by putting some starch into this vessel and afterwards adding iodide of potassium and mixing the whole contents of the vessel together. Now I take another vessel which contains chlorine; I open the bottle, hold the mouth downwards, and allow the contents to come in contact with the surface of the liquid. The gas immediately occupies the upper part of the vessel, and by agitating it a little you see this heavy gas has passed through the liquid and effected the chemical change which you notice in the darkening of the whole contents, owing to the formation of the deep blue coloured mixture.

So much for the question of the mere weight of gases, or, as we call it, their specific gravity or density. In fact, gases differ from each other in density far more than liquids or solids do from each other.

Another property in which gases differ from each other materially is in respect of their solubility. We have an illustration in the following table of the amount of solubility of various gases in water:—

Solubility of Gases in One Hundred Parts Water by Volume.

Hydric chloride	50,000
Ammonia	48,000
Sulphurous anhydride	5,000
Cyanogen	400
Dihydric sulphide	300
Chlorine	200
Nitrous oxide	130
Carbonic anhydride	100
Heavy carburetted hydrogen	8
Carbonic oxide	6·6
Nitric oxide	5
Oxygen	4·6
Nitrogen	2·5
Hydrogen	1·5
Light carburetted hydrogen	trace.

One of these you see is oxygen, so important for respiration. This gas is soluble to the extent of only 4·6 in 100 parts of water, but in the upper part of the table we have a gas—hydric chloride—which is soluble to the extent of 50,000 in 100 parts of water, and next to that ammonia, which is soluble to the extent of 48,000. That these gases have a solubility in water is evident in various ways.

I have here a vessel into which I can put a certain portion of water, so that we may observe its power of dissolving gases. A flask is attached thereto, in which I place liquid ammonia, and we shall drive off the vapour of the ammonia by means of heat. The gaseous ammonia will pass along the tubes and ascend to the upper part of the large globe, and we shall now have this glass vessel filled with the ammonia vapour. The result will be that we shall afterwards be able to show the solubility of the ammonia gas in water. I shall do so by first introducing a portion of water into the globe, and then tilting the vessel into an upright position. We afterwards lower the neck into a large basin of water, and the result is that there is a great absorption of the gas owing to the solution of the ammonia in the water.

Gases have very often a chemical relation to each other. Here we have in this vessel two gases which have a special property of entering into a state of chemical union with each other. I have here a clear, transparent gas—nitric oxide—which has no particular colour. It contains the same elements or ingredients as are present in ordinary air, but the substances are there in a particular state of chemical combination. Now, if we open this, and surround

it with a bell jar containing ordinary air, you will find we have at once developed a considerable quantity of this ruddy-coloured gas—hyponitric acid. In fact, we are working with two gases which have an important chemical action upon each other, and whenever they mingle chemical affinity comes into play, and we have the production of this very deep red-coloured compound.

Let us now endeavour to show you two other gases, or vapours, which to some extent may be regarded as having a chemical power of influencing each other. I have here a gas—nitric oxide—the same which formed the red colour you saw a moment ago, and I put into it a portion of bisulphide of carbon, and diffuse that throughout the vessel. You will find that it gives us a mixture of vapours which apparently have no great chemical action upon each other so long as they are unaided by heat. But if I bring into contact with this mixture a flame, you will find that a very rapid chemical action takes place. There will be no explosion, but a rapid burst of flame, showing the chemical energy which lies dormant in the mixture, until the application of heat, when we obtain a sudden flash of light.

We have pretty much the same thing even in regard to coal gas, with which many of you have to work so much. We have here certain vessels filled with coal gas. You will find that their contents present a perfectly colourless appearance, and that the gas itself has no power of combining with the air, and entering into union with the gases in it until you bring a light in contact with them. I need not tell you that if you turn on a gas-jet the gas will escape without any luminous appearance; but when a light comes in contact with the gas in the air, a chemical union takes place between the constituents of the gas and the air. It does not matter very much whether you place the gas in the air, or whether you attempt to place the air in the gas. Two things are required to produce this chemical union so as to form the luminous appearance, the one is the gas and the other the air.

The atmosphere contains a mixture of different gases.

Constituents of the Atmosphere.

Oxygen in 100 parts by volume	20·61	} 100·00
Nitrogen	77·95	
Carbonic acid	0·04	
Water vapour	1·4	
Ozone		} Traces.
Nitric acid		
Ammonia		
Carburetted hydrogen		
Hydrosulphuric acid		} Traces in towns.
Sulphurous acid		

Take, as an illustration, one of these vessels filled with ordinary coal gas and just arrange that a jet of very pure air be brought into contact with it—in fact that you have the presence of that substance in the air called oxygen. We shall take this jet of gas, and so arrange matters that we have our gas, which is in this vessel, set fire to in the first instance; then we shall turn on a jet of oxygen, taking care that the gas is reduced in quantity, and introducing the jet of oxygen into the jar of coal gas, the oxygen lights up and burns vividly in the atmosphere of coal gas.

But there is another way in which this same point may be observed a little better. If we take a large bell jar which contains a considerable quantity of coal gas, and just arrange that we have a small jet of oxygen passing into it, you will find that the jet of oxygen burns brilliantly in the coal gas. So that in this mode of burning of coal gas we have a very interesting point revealed to us—viz., that the air has to do with the combustion just as much as the coal gas has, and if you choose to burn ordinary air in coal gas you will get as good a luminous appearance as if you burnt coal gas in ordinary air.

The next point to which I wish to allude is in regard to what we call the diffusion of gases; *i.e.*, the power which gases have to mingle throughout each other—a power which they have quite contrary to what we notice with liquids. All gases, whatever be their respective weights, tend to diffuse rapidly throughout each other; but liquids do not necessarily do so. I take this vessel and put into it a certain portion of mercury. Upon this I put afterwards some coloured water, which you observe remains floating on the top. Above these we put a portion of ordinary oil, and that you see floats on the surface of the water. We, therefore, here get three distinct layers of liquids—liquids which have no ready chemical affinity for each other, but which simply assort themselves according to their weights. They remain in the order in which they were poured into the vessel—viz., the mercury, the water, and the oil. You might agitate them as much as you choose, but whenever they settle again, the order from the bottom would still be mercury, water, and oil.

Now that is what we notice with respect to liquids when they have no chemical action upon, and no solutive power towards each other. It is true that certain liquids have the power to mingle together. You have the familiar instance of alcohol and water—which we in the North are supposed to know so much more about than our southern brethren. If you take this alcohol and pour in a certain portion of water, the two at once thoroughly mingle with each other. You do not find either the one or the other floating on the surface. You might have expected that the alcohol, from being lighter, would float on the surface, and that the water, from its greater density, would sink beneath—as they certainly would do if these liquids had not a solutive powe with each other.

But when we come to gases—no matter what the respective weights of those gases are—you find that they have a power of rising up and becoming uniformly diffused through each other. And curiously enough they do so at certain rates which can be determined.

I have here a table of the

Diffusion of Gases.

	Specific Gravity.	Velocity of Diffusion.
Hydrogen	0·069	3·83
Marsh gas	0·559	1·344
Steam	0·623	—
Carbonic oxide	0·967	1·0149
Nitrogen	0·970	1·0143
Olefiant gas	0·978	1·0191
Air	1·000	1·000
Nitric oxide	1·039	—
Oxygen	1·1056	0·9487
Dihydric sulphide	1·191	0·95
Nitrous oxide	1·527	0·82
Carbonic anhydride	1·520	0·812
Sulphurous „	2·247	0·68

This table gives the specific gravity of the gases named and the velocity of their diffusion. And here, curiously enough, we find that the lightest gases diffuse with the greatest rapidity.

Take, for example, the light substance hydrogen, which, taking ordinary air as the standard, does not weigh the fourteenth part of ordinary air, and you will find that it has the greatest power of diffusion of every other gas. In fact, if I arrange an apparatus where we can take our extremely heavy carbonic acid—that gas which fell down through the air so readily when we turned the vessel round which contained it—and put it down in this globe, and then arrange to slip in this tube above it, and afterwards put over it a globe containing that lightest of all gases—viz., hydrogen—you will find that the arrangement of having the heavy gas below and the light gas above is only one which remains for a short time; and if by-and-by you proceed to estimate the exact composition of the gas in the upper part of this vessel, you will find that instead of it containing simply the lighter hydrogen, it will contain a certain proportion of the heavy gas, carbonic acid. No sooner are the two vessels brought together than the light gas begins to fall down through this tube, so that ultimately you will find it in the lower vessel; while a portion of the heavier gas you will find rising up, and occupying the upper part of the apparatus.

The rate at which gases diffuse is this—the lightest gases diffuse the quickest, but they do not diffuse exactly according to their lightness. Hydrogen is 14½ times lighter than air. It is 22 times lighter than the carbonic acid gas; but the rate of diffusion is not in the proportion of 22 to 1, but in the proportion of 5·5 to 1; that is inversely as the square root of the densities, which simply means that, instead of being at the rate of 22 to 1, it is at the rate of 5½ to 1.

Now this is a very important point, though it is one which is a little difficult to see at first. It is owing to this diffusion of gases that we have a thorough mingling of all the air in our rooms, and a thorough mixture of all the air outside of our rooms in our cities, and likewise in the different countries on the surface of the globe. Because, however we may have different mixtures of gases in ordinary air, and gases of different densities, as we have in the composition of the atmosphere, they all tend to diffuse and mingle throughout each other, according to this doctrine of the diffusion of gases.

Some liquids and certain substances in solution have a power of diffusing through each other. If a small vial be taken and filled with a solution of chloride of sodium (common salt), and carefully introduced into a jar containing water, the common salt will gradually rise out of the vial and diffuse itself throughout the bulk of liquid contained in the outer jar. If sugar or sulphate of magnesia be placed in the vial, the diffusion of these into the outer water will also take place, but not so rapidly; and if albumen (white of egg) or caramel (burned sugar) be inserted in the vial, the diffusion of those substances will take place very slowly. The following table gives the relative rates of diffusion of some liquids:—

Diffusion of Liquids.—Approximate Times.

Hydrochloric acid	1·00
Chloride of sodium	2·33
Sugar	7·00
Sulphate of magnesia	7·00
Albumen	49·00
Caramel	98·00

This experiment may be conducted in another way by placing the substances to be diffused in the lower part of a tall jar, and having water above. As the substance rises up and diffuses itself through the upper liquid, the rate of diffusion is observed. The following table gives the results of observations made on this point:—

Tar Diffusion.—Ten per Cent. Solutions for Fourteen Days.

No. of Stratum	Chloride of Sodium.	Sugar.	Gum.	Albumen.
1	0·104	0·005	0·003	—
2	0·129	0·008	0·003	—
3	0·162	0·012	0·003	—
4	0·198	0·016	0·004	—
5	0·267	0·030	0·003	—
6	0·340	0·059	0 004	—
7	0·429	0·102	0·066	—
8	0·535	0·180	0·031	0·010
9	0·654	0·305	0·097	0·015
10	0·766	0 495	0·215	0·047
11	0·881	0·740	0·407	0·113
12	0·991	1·075	0·734	0·343
13	1·090	1·435	1·157	0·855
14	1·187	1·758	1·731	1·892
15&16	2·266	3·783	5·601	6·725
	9·999	10·003	9·999	10·000

It will be observed that the chloride of sodium rises quickest in the jar, whilst the albumen lags behind and diffuses slowly, in fact does not reach one-half the height of the water in the jar during the time required for the chloride of sodium to reach the top layer.

We have also the transpiration of gases, which means the passage of gases through extremely minute tubes. If I take a piece of glass tube and heat it and draw it out like this piece of rubber tube, it still remains a tube, and if we attempt to pass gas through it we carry out what is called the transpiration of gas. I have here a table which shows the

Transpiration of Gases.

	Time. Equal Vol.	Relative Velocity.
Oxygen	1·0000	1·000
Air	0·9030	1·107
Nitrogen	0·8768	1·141
Nitric oxide	0·8764	1·141
Carbonic oxide	0·8737	1·144
Nitrous oxide	0·7493	1·334
Hydric chloride	0·7363	1·361
Carbonic anhydride	0·7300	1·369
Chlorine	0·6664	1·500
Sulphurous anhydride	0·6500	1·538
Dihydric sulphide	0·6190	1·614
Marsh gas	0·5510	1·815
Ammonia	0·5115	1·935
Cyanogen	0·5060	1·976
Olefiant gas	0·5051	1·980
Hydrogen	0·4370	2·288

You see by this table that oxygen is the slowest in regard to time, and that air comes next afterwards. All these gases differing in properties—light and heavy gases—have certain rates at which they do pass through these tubes; but, curiously enough, we have not yet determined any law which regulates the rate of transpiration. We do not find that the heavier gases pass quicker than the light gases, or the light ones quicker than those which are heavy, so at present there is no law by which we can determine the rate of transpiration as is the case with the diffusion of gases.

There is one other important point in connexion with gases, and that is with regard to the passage of one to the other by means of a diaphragm. This subject was worked out very fully by the late Professor Graham, the Master of the Mint, one of those bright stars that our southern brethren sometimes take away from our northern regions. To him we are indebted for nearly all we know as to how gases do pass through and mingle with each other. Well, he studied the subject in connexion with both liquids and the gases, and probably the best way of seeing how far or how important are the discoveries with regard to the gases would be first to explain the question as to the liquids. And it may be shown in this way. We take a diaphragm such as this piece of parchment paper. All you require to do in order to make the parchment paper is to act upon it with a certain mixture; and we find the best mixture for the purpose is oil of vitriol and water. I put a mixture of oil of vitriol and water into a vessel and draw a piece of paper through

it. But then we must have another vessel containing a solution for the purpose of neutralizing the acid which has come from the first one. This is a solution of ammonia and water. Now, I take a piece of ordinary blotting paper—a paper which you know has no great strength of itself, and which if passed, as I now pass it, simply through water, comes out in such a condition that you can tear it readily to pieces, for there is no cohesive strength in it whatever. But let me take a sheet of the same paper and pass it through the oil of vitriol and water; then transfer it to the second vessel containing the ammonia and water, so as to neutralize a portion of the acid left in it, and subsequently wash it thoroughly. We now take it out, and I have a paper which is like a piece of leather—it is so tough that you try in vain to tear it to pieces. This paper forms about the best material for carrying on our experiments in the dialysis of liquids. But there is one point in reference to the preparation of the paper which I may mention, and that is that in the first vessel you must have exactly two parts of vitriol and one of water. If you have it stronger it will not do, and anything weaker will not do. If, for instance, I take another piece of the same paper, and treat it with a less strong solution of the vitriol, you will see that in drawing it through the paper hardly keeps itself together, but breaks up into shreds. This shows how extremely nice we must be in having the exact proportions—two parts of vitriol and one of water—to enable us to prepare this paper.

Now, I take a piece of this paper so prepared, and soak it in a vessel containing water, and stretch it across a frame made of a piece of ordinary gutta percha with a ring around it, in this way, and I very quickly form a kind of sieve. I take this sieve and put it in an outer vessel in which we can float it. You will find that if I put into this sieve certain substances, some of them will pass readily through and others will not.

I take as an illustration a portion of ordinary minced meat, to show one important application of it. I add to that a small portion of arsenic and mix them together, forming a compound of animal matter and the arsenic, and I throw the whole of this upon the diaphragm. Let there be between the outer and the inner liquid this piece of parchment paper, and you will find that the elements of the meat hardly go through at all, but the arsenic begins at once to pass through into the outer liquid, so that by-and-by you will find a certain proportion of it there.

Now, a law has been deduced as to the manner in which liquids and solids can pass through this diaphragm, and it has been found that those which are crystalline pass through very quickly—such as sugar, Epsom salts, &c. Other bodies, or, as we call them, albuminous matters, such as white of egg, pass through very slowly indeed.

Dialysis.—Relative Diffusate—Two per Cent. Solutions.

24 Hours at 12° C.

Sodic chloride	1·000
Picric acid	1·020
Ammonia	0·847
Thein	0·703
Salicin	0·503
Cane sugar	0·472
Amygdalin	0·311
Extract of quercitron	0·184
„ logwood	0·168
Catechu	0·159
Extract of cochineal	0·051
Gallo-tannic acid	0·030
Extract of litmus	0·019
Caramel	0·005

In this way, therefore, we find that liquids or solutions of substances have the power to pass through the diaphragm or of being subjected to the process of dialysis, the crystalline passing much more quickly than the albuminous.

Well, working out the subject in connexion with gases, it was found that using very thin pieces of india-rubber or caoutchouc, and stretching these across vessels or tubes, we can pass gases through them, and that some gases have the power to pass through quickly in one case and slowly in another; in fact, that certain gases pass through with great rapidity and that others are kept back. The rate of the diffusion of gases through an india-rubber diaphragm or septum is given in this table:—

Dialysis of Gases.
Septum of India-rubber.

	Time, Equal Vol.	Relative Velocity.
Nitrogen	13·585	1·00
Marsh gas	6·326	2·15
Oxygen	5·316	2·55
Hydrogen	2·470	5·50
Carbonic anhydride	1·000	13·58

Now, one of the results of this dialysis of gases may be of the greatest importance with regard to the composition of our own atmosphere. You find that in 100 parts by volume of atmospheric air there are nearly 21 parts of oxygen and 79 of nitrogen. These are the proportions most conducive to health, and which are present in all free air. But if you attempt to pass this air through a diaphragm, you will find that the oxygen will pass at the rate of 2½ times, while the nitrogen will pass only to the extent of 1. And this leads to the consideration of the question of the filtration of our air. We can actually increase the quantity of the oxygen, which is the invigorating substance, by transmitting the air through this septum of india-rubber. How largely this may be done is shown in the following table:—

Atmospheric Air.

A	Oxygen	21 × 2·55 = 53·55	or 40·4	per cent.
	Nitrogen	79 × 1·00 = 79·00	„ 59·6	„
B	Oxygen	40 × 2·55 = 102·00	„ 61·72	„
	Nitrogen	60 × 1·00 = 60·00	„ 38·28	„

These figures show (A) that if ordinary atmospheric air be transmitted through the rubber septum, the per centage of oxygen is increased to 40·4, and (B) if this oxygenized air be again transmitted through a layer of rubber, the per centage of oxygen will be still further increased to 61·72 per cent.

The dialysis of gas, therefore, is of very great moment in respect of the separation of one gas from another, and may come to be of great value with respect to increasing in the atmospheres of our rooms a larger proportion of oxygen, because if the windows of our rooms had their frames fitted with a septum of india-rubber the proportion of oxygen might be increased greatly above the proportion which we find as the normal quantity in the open atmosphere.

One other point before I have done. Certain gases have the power of being absorbed by metals, and transmitted to a very large extent indeed. The metals which have the power of absorbing and transmitting gases are principally the metal platinum, and another metal called palladium. When ignited the platinum transmits hydrogen with great rapidity, whilst it is practically closed to marsh gas. The relative rates of diffusion are as follows:—

Septum of Platinum.

Hydrogen	100·0
Marsh gas, &c.	0·01

Platinum has long been known to have this curious property of compelling a union of gases. If you take even our ordinary coal gas, and allow that coal gas to impinge upon a piece of platinum, you will find that you can readily support the platinum at a red heat. I take as an illustration a quantity of gas which we can burn from this jet; it is rather a large jet, and we can consume a very considerable quantity of gas. We extinguish the gas, and having got a small piece of platinum—which has the power to absorb gas—we shall have an illustration of the manner in which it is done by the way in which it tends to keep up the combustion after it has left this source of heat. You here notice how in a mysterious way the platinum keeps glowing in the upper part, and will continue to glow while the mingled gas and air surround it.

The mysterious way in which this piece of platinum keeps at the high temperature is due to this—that it has the power of condensing within its pores a certain portion of the gases, and compelling their chemical union very quickly within those pores, and this chemical combination leads to the development of the heat which keeps the platinum at a high temperature.

Another way to observe the same phenomenon in a more striking manner is to work with ammonia and oxygen. I take here some of the liquor ammonia, and will place it in this flask. The vapour diffuses itself throughout the upper part of the vessel. Then I take a piece of platinum and heat it first in the gas. You see it glows as long as the flame is connected with it. And now I put it into the vessel containing the vapour of ammonia, and it still continues to glow in this vessel, so that you see it is absorbing a certain amount of gas, and still proceeding to cause a certain combustion of the constituents. I am now going to throw in a little oxygen, which will increase the energy of the action, so that the platinum, which has been at a red heat, will rise to a white heat, and there will be a much more rapid combustion of the constituents in our vessel, and explosion after explosion of the mixed vapours will take place. These combustions and explosions are due to the particular power which the platinum has of absorbing certain gases, and causing a chemical union within its very pores.

One of the substances I referred to—palladium—absorbs 600 or 700 times its own volume of oxygen; in fact, it combines with it so thoroughly that the alloy may be stamped out into medals, and still retain that large volume of gas in it.

The absorption of gases by charcoal has been long known, and the results of many observations are given in the following tables:—

Absorption of Gases by One Part of Charcoal by Volume.

Ammonia	90·0
Hydric chloride	85·0
Sulphurous anhydride	65·0
Dihydric sulphide	55·0
Nitrous oxide	40·0
Carbonic anhydride	35·0
Heavy carburetted hydrogen	35·0
Carbonic oxide	9·4
Oxygen	9·2
Nitrogen	7·2
Light carburetted hydrogen	5·0
Hydrogen	1·7

Absorption of Gases.—Relative Values of Wood, Peat, and Animal Charcoal.

Charcoal.	Ammonia.	Hydric Chloride.	Dihydric Sulphide.	Carbonic Anhydride.	Oxygen.	Sulphurous Anhydride.
Wood	98·5	45·0	30·0	14·0	8·0	32·5
Peat	96·0	60·0	28·5	10·0	6·0	27·5
Animal	43·5	—	9·0	5·0	5·0	17·5

One part of charcoal, therefore, absorbs fully 90 times its own volume of ammonia vapour.

I have endeavoured to-night shortly to refer to some of those peculiar physico-chemical properties of gases which may not come every day within the cognizance of all of us. These properties of diffusion and dialysis, both with respect to gases and liquids, are undoubtedly of the greatest importance, though we cannot as yet, in many ways state what their full utility is. In the living system all these processes must perform most important functions in regard to the composition of the air of our rooms, and the absorption of liquids and solutions, as well as the interchange of gases. It is probable that even in the manufacture of coal gas some of those peculiar properties may have a technical bearing.

The practical utility of many of my observations may not be observed at once, and may be still hard to seek. But the history of all inventions shows that little by little is the structure of discovery reared, and that scientific facts and observations often lie dormant for years, even for generations; then some happy thought links them together, or some happy discovery reveals the missing link, and the world is enriched by the development of some great branch of industry conducing to the welfare of mankind. But independently of the utilitarian aspect of the question, we ought to endeavour to learn truth—to know truth. To do so, man becomes elevated from a mere labour-machine to be an intelligent son of toil, and a more faithful servant of the trust reposed in him by his Maker, the Creator of all.

On the motion of the PRESIDENT, a cordial vote of thanks was passed to Dr. Macadam for his able and interesting lecture.

NORTH BRITISH ASSOCIATION OF GAS MANAGERS.

The Twelfth Annual General Meeting of the North British Association of Gas Managers was held in the Hall of the Royal Scottish Society of Arts, Edinburgh, on Tuesday, June 10—Mr. B. M. M'CRAE, Dundee, President, in the chair. There was a large attendance of members.

The proceedings were opened with an address by the president, which, with the papers subsequently read and the discussions thereon, will appear in our next.

On the motion of Mr. JOHN REID, a cordial vote of thanks was accorded to Mr. M'CRAE for his address.

The SECRETARY (Mr. W. Mackenzie) read minutes of the last annual meeting, held at Perth on July 19, 1872; also minutes of committee meetings held on March 12 and May 13 last.

The following gentlemen were then proposed for election, and unanimously admitted as ordinary members—viz., Messrs. Ambrose, Tillicoultry; William Smith, Banbridge; J. Foster, Portobello; James Whimster, Glasgow; David Stiven, St. Thomas; John Stiven, Panama; J. Hall, St. Andrew's; and William Marr, Linlithgow.

Messrs. James M'Kelvie, Edinburgh, and D. M. Nelson, Glasgow, were also admitted as extraordinary members.

PROPOSED AMALGAMATION WITH BRITISH ASSOCIATION.

The PRESIDENT then intimated that the next business before the meeting was the question of proposed amalgamation with the British Association of Gas Managers. He called upon the secretary to read the minutes of the various meetings of the committee, together with minutes of the last annual meeting.

The SECRETARY having read these,

The PRESIDENT, in moving their approval, referred more particularly to the resolutions adopted by the committee of the British Association, and the subsequent decision of this committee thereon at its meeting held on the 13th of May last, which resolutions are as follows, viz.:—

Resolutions by Committee of British Association.

1. *Resolved:* "That in consequence of the wish expressed by the North British Association of Gas Managers, that an amalgamation, affiliation, or other friendly relationship should be formed between this society and the British Association of Gas Managers, and the earnest desire of the committee to promote the interests of the members of both institutions, the committee of this association are prepared to recommend to its members an amalgamation of the two bodies, providing the North British Association are willing to conform to the rules and regulations of the British Association."

2. *Resolved:* "That in the event of the foregoing proposition being demurred to by the North British Association of Gas Managers, the committee of this association would recommend that the meetings of each association be open to the members of both associations in common, and that a special deputation be appointed from each association to visit the meetings of the other."

Resolution by Committee of North British Association.

"After due consideration and consultation with Mr. Bennett, secretary of the British Association, the meeting unanimously agree to approve of the resolutions now submitted, and *resolve* to recommend to the members that the amalgamation be carried into effect at the forthcoming annual meeting."

Mr. BROWN (Arbroath) begged to second the approval of the minutes, together with the committee's recommendation to amalgamate.

Mr. WHIMSTER (Perth) asked the nature of the clause "providing," &c.

Mr. REID (Leith) explained that this simply meant conformity to the rules of the British Association, which rules were similar to those of this association.

Mr. ROBB (Haddington) stated that affiliation would better meet his views than amalgamation, but under the circumstances he would support the motion, and would suggest that one of the terms of union should be, that the meetings of the united association be held as frequently as possible in Scotland.

Mr. WHIMSTER intimated his opinion that the proposal to amalgamate was agreed to at last annual meeting, and asked the president if this was so.

The PRESIDENT explained that the committee had, in terms of the remit to them by last annual meeting, fully considered the matter, and now submitted their resolutions thereon for the approval or otherwise of this meeting.

Mr. KEY (Dumbarton), while understanding also that amalgamation was agreed upon by the members at last annual meeting, strongly pressed upon the members the importance of the establishment of annual branch or sectional meetings in Scotland on those years in which the general meetings of the united association are held in England or elsewhere.

Mr. M'PHERSON (Kirkcaldy) expressed generally his approval of Mr. Key's views, and suggested that, in the event of amalgamation, two sections—say a northern and southern—be established, for the special benefit of the members in these districts.

Mr. WHIMSTER said that as he understood the committee were expected to prepare a basis of union to submit to this meeting, he now begged to be informed what advantages would follow to this association were the union effected.

The PRESIDENT stated that no terms could be named or accepted until the present meeting should decide by approval or otherwise.

Mr. WHIMSTER moved—"That this meeting has received with pleasure the committee's recommendation that the amalgamation be carried into effect; appoint a committee to meet with a committee of the British Association in order to make and define the conditions of union, and submit the same to an adjourned meeting of the members to be held here to-morrow (Wednesday) forenoon, at eleven o'clock."

Mr. JOHN YOUNG (Bonnyrigg) seconded this amendment.

Mr. GIBB (Armagh) submitted that the committee, having previously been in communication with the committee of the British Association, had already accomplished all that could now be gained by a personal conference.

Mr. BARTHOLOMEW suggested for the guidance of the committee now proposed to be appointed, that the amalgamated association should meet in Scotland, say once in every five years.

The PRESIDENT having put the amendment and motion to the meeting, declared the former to be carried.

The meeting then appointed the following committee to meet with the committee of the British Association, viz.:—Mr. B. M. M'Crae, Mr. W. Foulis, Mr. John Reid, Mr. J. K. Watson, Mr. G. R. Hislop, Mr. G. F. Cusiter, Mr. William Key, Mr. George Boyd, Mr. William Mackenzie. The meeting then adjourned.

WEDNESDAY, JUNE 11.

The adjourned meeting of the association took place to-day, when the PRESIDENT (Mr. B. M. M'Crae) took the chair at eleven o'clock.

The PRESIDENT intimated that the committee appointed yesterday had met with a similar committee of the British Association, and he now submitted the result of the joint meeting. The terms submitted by your committee were as follows:—

1. "That the designation of the amalgamated societies be the 'United British Association of Gas Managers.'"

2. "That the united association hold their annual meetings in Scotland at least once in five years."

3. "That a branch meeting of the united association be held annually in Scotland, the transactions of such meetings to be reported and published along with the transactions of the society."

4. "The arrangements for all meetings to be made and conducted by the committee of the united association."

After consultation, the committee of the British Association declared their unwillingness to accede to the 1st and 4th heads of agreement, but were quite prepared to recommend to their members an amalgamation on the 2nd and 3rd.

Mr. ALEXANDER (Corstorphine) moved—"That this association, while desirous of promoting the utmost cordiality between themselves and their English brethren, and to foster this approve of joint stated meetings, still consider that the interests of both associations would be better conserved were each association to continue to have the control and management of its business and funds, and for this purpose propose that this association, for a time at least, remain in a separate state."

Mr. SCOTT (Musselburgh) seconded the motion.

Mr. BARTHOLOMEW moved—"That this association do now amalgamate with the British Association on the conditions agreed to by its committee."

Mr. SMITH (Banbridge) seconded this amendment. Considerable discussion hereafter ensued, and on the amendment and motion being put to the meeting the latter was declared carried.

The president was appointed to make intimation of this decision to the president of the British Association.

The meeting then proceeded to the election of office bearers for the current year, when Mr. William Foulis (Glasgow) was elected president, and Mr. G. R. Hislop (Paisley), vice-president, and Messrs. Robb (Haddington), Boyd, (Alloa), Foster (Portobello), and Innes (Forfar), members of the committee. Mr. Wm. Mackenzie (Dunfermline) was re-appointed secretary and treasurer; and Mr. William Fraser (Iverkeithing) auditor. It was agreed to hold the next annual meeting in Glasgow about the middle of July, 1874.

The members of this association united with their brethren of the British Association in the various entertainments provided for them by the friends in Edinburgh, of whose extreme kindness and generous hospitality they desire to record their full appreciation.

SYMES'S PATENT ECONOMIC GAS COMPANY, LIMITED.—The liquidators of this company have declared a first dividend of 10s. in the pound.

METROPOLIS WATER SUPPLY.

The following are the returns of the Association of Medical Officers of Health relating to the composition and quality of the metropolitan waters, in June, 1873:—

NAMES OF WATER COMPANIES.	Total Solid Matter per Gallon.	Oxygen required by Organic Matter, &c.	Nitrogen.		Hardness.	
			As Nitrates, &c.	As Ammonia.	Before Boiling.	After Boiling.
Thames Water Companies.	Grs.	Grs.	Grs.	Grs.	Degs.	Degs.
Grand Junction	18·40	0·046	0·115	0·001	14·6	3·3
West Middlesex	17·10	0·029	0·126	0·000	14·1	3·0
Southwark and Vauxhall	18·10	0·043	0·104	0·001	14·2	3·4
Chelsea	17·70	0·042	0·115	0·002	14·0	3·3
Lambeth	17·93	0·044	0·105	0·002	14·1	3·4
Other Companies.						
Kent	27·90	0·004	0·243	0·000	20·8	6·0
New River	17·63	0·019	0·147	0·000	14·3	3·8
East London	17·47	0·038	0·165	0·002	14·3	3·6

Note.—The amount of oxygen required to oxidize the organic matter, nitrites, &c., is determined by a standard solution of permanganate of potash acting for three hours; and in the case of the metropolitan waters the quantity of organic matter is about eight times the amount of oxygen required by it.

The water was found to be clear and nearly colourless in all cases but the following, when it was very slightly turbid—namely, in those of the Chelsea and the Grand Junction Companies. The average quantity of water supplied daily to the metropolis during the preceding month was, according to the returns of the water companies to the Association of Medical Officers of Health, 115,893,425 gallons; and the number of houses supplied was 503,562. This is at the rate of 35 gallons per head of the population daily. The last official return from Paris stated that the average daily supply per head of the population was 30·5 gallons; but this includes the water used for the public fountains, and for the ornamental waters in the Bois de Vincennes and the Bois de Boulogne.

HY. LETHEBY, M.B.

Mr. W. R. Morris, engineer to the Kent Water-Works, states that there are now over 900 miles of water-mains in the metropolis constantly charged, which could be made at all times instantaneously available in cases of fire upon the line of such pipes, if the Metropolitan Board of Works would exercise their legal powers in putting hydrants thereon. Mr. Morris adds: "Hitherto no attention has been paid by that body to the representations made to them by metropolitan water companies upon this fact."

METROPOLITAN BOARD OF WORKS.—At the meeting of the board on Friday last, the Works and General Purposes Committee reported that their attention had been directed by the solicitor to a question put to the Home Secretary by Mr. Agar-Ellis, M.P., and the reply of Mr. Stansfeld. The object of the question was to ascertain what steps the Home Secretary had taken, or was about to take, to give effect to the Metropolitan Water Act of 1871, as the clause requiring a constant supply had been proved to be altogether inoperative to ensure a constant high-pressure supply of water for fires in the metropolis. Mr. Stansfeld, in reply, said he had taken no steps in the matter, and stated further that the work was vested in the Metropolitan Board of Works, in the first instance, to require a constant supply of water; and if they refused to make the request, or there was any unreasonable delay in making it, the Local Government Board would require it to be done; that he was not aware any action had been taken by the Metropolitan Board in the case of the question referred to, and if there was any unreasonable delay in the matter the Local Government Board would have to consider what course it would be desirable to adopt. The board would recollect that a full report on the operation of the Act of 1871 was presented by the committee on the 7th of February last, and the subject was referred back to them, with authority to represent to Her Majesty's Government the imperfect state of the law and the necessity for new legislation. The committee had endeavoured to obtain an interview with the Prime Minister, but owing to the great pressure of other matters he had not been able to receive them. Under those circumstances it did not appear to the committee that it rested with the board to initiate any communication with the Local Government Board in reference to the question and answer above mentioned, and they therefore recommended that no action should be taken in the matter. Mr. Newton moved the adoption of the report, and said the only intimation the board had of the question and answer had been derived from the newspapers. The report was adopted.

PONTYPOOL PUBLIC LIGHTING.—A special meeting of the Pontypool Local Board was held on the 20th ult.—Mr. Edwards in the chair—to receive a communication from the gas company as to their conditions and price for supplying the public lamps from the 1st inst. The offer of the company was as follows:—"1. The company will supply you with gas for the street-lamps for twelve months from the 1st day of July next to the 1st of July, 1874, at 4s. 6d. per 1000 cubic feet, the quantity to be consumed to be ascertained by your providing and fixing a meter (to be approved by the company) to every tenth lamp, and a Sugg's governor to each lamp throughout your district; and on condition that you thoroughly repair and alter the whole of the lamps so that they can be lighted with the torch, my directors will be prepared to undertake the repairing, cleaning, lighting, and extinguishing, as at present, for the sum of 15s. per lamp, for one year; although they would much prefer that the local authorities would undertake the entire management of the street-lamps, the gas company simply supplying the gas. 2. On condition that you alter the lamps as above, and affix a Sugg's governor, calculated to burn at the rate of 5 cubic feet per hour to each lamp, my directors will undertake to supply gas, repair, clean, light, and extinguish the lamps for the sum of £4 15s. per lamp for one year from the 1st day of July, 1873, to the 1st day of July, 1874." The chairman said the former charge in the town was £3 9s. (or £3 7s. 6d. without cleaning) for each lamp, and there were 76 lamps; at Neath the former charge was £3 10s. per lamp for the eleven months, and now it was £4 10s. for the eleven months, at the rate of £4 17s. 6d. for the whole twelve months, and there they had 151 lamps; at Chepstow the present charge was £5 4s. 8d., and the local board did the repairs; at Troedyrhiew the price was £5 per lamp; and at Swansea the charge was 4s. per 1000, and 15s. per lamp for cleaning, and there were 700 lamps. Mr. Wilton asked what was charged at Abergavenny. The chairman said that at Abergavenny the gas-works belonged to the town, and at Newport there was a contract for coal for a number of years at a very cheap rate, and therefore their rates could not be taken as a criterion. Mr. Wilton: Does the company intend to alter the price to private consumers? Mr. Greenway: The company are most anxious to defer that point till the latest moment, but if the coal keeps up as it does at present the company will be compelled to raise the price. Mr. Wood said that this board might follow the example of Neath, and only light the street-lamps eleven months in the year; but this suggestion did not meet with general approval. It was ultimately agreed to adjourn the subject until the next meeting.

REMARKS ON CONDENSATION PRODUCTS OF GAS.

By Robert Gasch.*

[Our readers will remember that in the report on sulphur purification by the late referees (see JOURNAL for April 23, 1872, p. 346), they expressed an opinion, founded upon an observation of Mr. Kirkham, that sulphur compounds other than bisulphide of carbon are present in purified gas. We ourselves have never had a doubt as to the presence of such compounds, although no one has yet been isolated. The author of the paper, of which we give a short abstract below, has gone some length towards their identification, and gives strong reasons for supposing them to be mercaptans. It is a matter of scientific rather than practical interest, for the amount of these bodies present in gas must be exceedingly small; but the ordinary means of purification will fail to remove them.]

In renewing the pipes between the purifiers and gasometers at Dresden, the author obtained a small quantity of tar oil, and an abundance of the same substance was subsequently found floating on the water of the gasholders, and in various localities of the network of mains. When recently deposited this oil has a yellow colour and is transparent, but in time it changes into a heavy, dark, black, tarry substance.

It is well known that the light benzole vapours are occasionally carried along with the gas, and that even the heavy naphthaline may be present in it, and it is not unreasonable to assume that all those hydrocarbons, whose boiling point is between that of benzole and naphthaline, may also occur in gas.

After collecting a quantity of these condensed products in several situations, the author subjected them to a slow fractional distillation, with the view of ascertaining the amounts of light and heavy oil and of naphthaline, the distillation being in each case carried on until naphthaline made its appearance at the outlet of a Liebig's condenser, an occurrence which always took place very suddenly.

The results obtained by the distillation of the condensed products were as follows:—

	Oils Collected.				
	Before the Purifiers.	From Gasometer.			From Syphons in town.
		E and D. Under Cover.		E and D. Exposed to Air.	
Specific gravity	0·997	.. 0·925	..	0·920	..0·992
Volumes of distillate obtained by distilling 100 parts at a temp. of 212° F.	3	.. 6	..	6	.. 4
at 266° F.	5	.. 7	..	8	.. 8
at 302° F.	5	.. 9	..	15	.. 6
at 356° F.	19	.. 36	..	35	.. 31
at 365° F.	—	.. —	..	—	.. 8
at 376° F.	—	.. 15	..	—	.. —
at 379° F.	15	.. —	..	12	.. —
Total amount of distillate	47	.. 73	..	76	.. 57
Residue	50	.. 23	..	22	.. 42
Loss	3	.. 4	..	2	.. 1

The loss includes gases which escaped during the distillation. The residue of the the three first columns varied in colour from brown to black, solidified on cooling, and consisted almost entirely of naphthaline. Residue of column 4 was black, tenacious, did not solidify, and had a repulsive odour. These condensed products varied in their relative amount of light and heavy oil and naphthaline, according to the time of the year, whether condensed in winter or summer, and according to the locality where deposited. The oils collected nearest to the purifiers of the gas-works were richest in naphthaline, while an oil of the lightest specific gravity (·910) was collected nearly half a mile away from the works.

During the distillation of the oil of column 4, found in the syphons of the town, the author observed for the first time, near the end of the condenser, a strong smell of sulphuretted hydrogen, the real nature of which he further demonstrated by acetate of lead paper. This sulphuretted hydrogen made its appearance between the temperatures of 212° to 266° Fahr., and increased with the process of the distillation. It could only arise from the presence of sulphur oils, as the author felt sure that for years no sulphuretted hydrogen could be found after the purifiers, and much less in the network of the town pipes. The presence or absence of sulphuretted hydrogen in the undistilled oils could not at once be proved, because the oils then at disposal were all of a black colour, but subsequently lighter coloured oils were obtained especially from one of the largest gas-works in Germany, where an additional purifier was in use, which served to remove even the slightest traces of sulphuretted hydrogen, and where guarantee of the perfect purity of the gas was given. None of these light-coloured oils blackened or darkened lead paper, but furnished sulphuretted hydrogen during their distillation, showing that they did not contain this gas ready formed, but that it was a product of subsequent decomposition. The presence of sulphur compounds, and the absence of sulphuretted hydrogen in the light and dark oils was afterwards proved by nitro-prussid of sodium, warming the oils with a small piece of potassium, and adding water subsequently. To ascertain the exact nature of these sulphur compounds it would be necessary to obtain them in a state of purity, and to subject them to analysis, which is almost an impossibility. Sulphur has a great affinity for nearly every element; it is therefore very probable that these sulphur combinations are very numerous and manifold. The following observations justify the belief that these compounds are mostly mercaptans:—1. These oils before and after distillation possess a peculiar repulsive odour. 2. Acetate of lead paper is changed into a lemon colour when placed near the end of the condenser during the distillation at a temperature of 212° to 266° Fahr., and mercaptide of lead is of a light yellow. 3. Lastly, these oils produce peculiar precipitates with salts of metals, that with salts of mercury having all the appearance of mercaptide of mercury. Mercaptans, according to the theory of types, are regarded as alcohols, in which oxygen is replaced by sulphur. These bodies form a whole series of compounds according to the introduction of one or the other alcohol radical.

Most of the sulphur compounds contained in these oils can hardly be decomposed by lime or the hydrated sulphide of calcium, which accounts for the continual occurrence of sulphur in the gas at Beckton. The only remedy would be the troublesome and expensive process of passing the gas over red hot metallic oxides. The increase of the sulphuretted hydrogen smell with the rise of temperature beyond 212° proves that bisulphide of carbon has nothing to do with it, as this sulphur compound distils over long before with the first few drops of distillate.

In distilling a large quantity of condensed oils at a very low temperature below 212°, benzole and traces of bisulphide of carbon were obtained. By fractionation at lower temperatures distillates were obtained which had a rather agreeable aromatic odour, and probably consisted of mixtures of caproyl, amyl, butyl, and may be propyl hydrides; they are, in fact, merely tar oils which with the gas have escaped the condensers and scrubbers. These, like benzole and acetylen, no doubt add to the illuminating power of gas. They are most abundantly produced by distilling coal at low temperatures; this is, however, not practicable in gas manufacture, and it is better to allow these oils to pass the condensers and scrubbers by judiciously lessening their condensing power, taking care, however, to arrest the tar and naphthaline. Pure naphthaline requires a temperature of from 374° to 392° for volatilization, but when carried in solution or suspension by the light vapours of benzol, toluol, &c., the temperature may be much lower. The stoppage of gas-pipes by naphthaline is, comparatively speaking, of rare occurrence; it requires special conditions of temperature. The frequent changes during the day from cool to warmer alone tend to prevent them, and if they do occur, they happen mostly in spring and autumn, when the difference of temperature during day and night is greatest and most permanent. In summer the gas is always richer in volatile oil and naphthaline, and consequently of higher illuminating power than in winter, when these compounds are more readily condensed.

* *Journal für Gasbeleuchtung*, No. 3, pp. 47-54; No. 4, p. 65.

Price of Gas at Bath.—We are informed that at the half-yearly meeting of the gas company the directors reported that they had decided to defer their decision upon the question of a rise in the price of gas until the end of the company's current financial year.—*Bath Chronicle.*

Arbroath Gas Corporation.—The balance-sheet of this corporation for the year ending the 31st of May states the cost of materials at £4263, an increase of £1285, and the surplus revenue at £19 2s. 7d., in comparison with upwards of £1000 in the previous year. In each of the two first years since the gas-works were transferred to the council, a surplus of more than £1000 was expended—one-half being on street improvements, and the other in discounts to consumers. The discounts, which reduced the price of gas to 5s. 5d. per 1000 feet, will be discontinued, and there will be nothing to spend upon improvements.

Gas Explosion at Bradford.—On Saturday morning last a fire broke out in the weaving shed in the joint occupation of Messrs. Hill and Co., Messrs. Wade and Glyde, and Messrs. Walker, spinners and manufacturers, in Pratt Street, Bradford, and this occurred, from some cause unexplained, immediately after some gasmen had been effecting repairs at the meter in the cellar. The corporation fire brigade was called to the place, and when they had apparently subdued the fire a serious explosion of gas followed, with considerable destruction of property, and the injury of several of the firemen. Many windows were broken, and several doors torn off. Nearly all the firemen were scorched and had their hair singed. Some were removed to the infirmary and some to neighbouring druggists. It is supposed that the gas from the meter in the cellar had been for some time escaping. The principal damage was in the part of the premises occupied by Messrs. Hill and Co. The damage is estimated at about £1000.

Dutch Water-Works Company, Limited.—Mr. Whiffin, as official liquidator of this company, having, with the sanction of the court, paid the creditors of the company 20s. in the pound, has now issued notices for the first return to the shareholders of £2 10s. per share out of £5 paid.

Wakefield Water-Works Company.—At an extraordinary meeting of shareholders, held on the 16th ult., it was resolved to authorize and empower the directors to create and issue *pro ratâ* among the shareholders 3000 new shares, of £10 each, with a guaranteed preference dividend of £5 per cent. per annum for five years, from the 1st of this month, and at the expiration of that period the shares to become ordinary shares, but the dividend not to exceed 7 per cent. per annum.

Register of New Patents.

APPLICATIONS FOR LETTERS PATENT.

2016.—Livesey, G. T., South Metropolitan Gas-Works, Old Kent Road, "Improvements in apparatus used in the manufacture of gas." June 6, 1873.

2017.—Kidd, J., Leadenhall Street, "Improvements in gas-burners." A communication. June 6, 1873.

2021.—Shanks, J., Barrhead, N.B., "Improvements in and connected with valves and waste-preventive apparatus for water-closets, baths, lavatories, and similar apparatus." June 6, 1873.

2047.—Hinks, J., Birmingham, and Holland, H., Birmingham, "Improvements in the manufacture of gas for heating and illuminating, and in the utilization of residual products of the said manufacture." June 9, 1873.

2070.—Wincen, H., Newforth-under-Lyme, Stafford, "Improvements in gas-meters." June 11, 1873.

2071.—Leigh, J., Manchester, "An improved mode of treating sewage and other contaminated waters." June 11, 1873.

2152.—M'Avoy, H. L., Baltimore, U.S.A., "Improvements in apparatus for carburetting air for illuminating or heating purposes." June 19, 1873.

2174.—Louttit, K. M'L. P., Greenwich, "Improvements in the manufacture of gas for heating and lighting purposes, and in the apparatus employed therefor." June 21, 1873.

2177.—Hunter, A. G., Flint, North Wales, "Improvements in apparatus for the manufacture of gas for illuminating and heating purposes." A communication. June 21, 1873.

2192.—Sweet, A., Hampstead Road, "Improvements in water-waste preventers and waste-preventing cocks, taps, or valves." June 24, 1873.

2199.—Nicholson, R., Dulwich, Surrey, "Improvements in junctions for gas and water mains and branches." June 24, 1873.

2209.—Imray, J., Southampton Buildings, London, "Improvements in modules or apparatus for regulating and measuring the delivery of water or other liquids." A communication. June 25, 1873.

2214.—Ross, O. C. D., Craven Street, Strand, "Improvements in the production of vaporized air for heating purposes generally, and in means for regulating and controlling the admixture of vaporized and other air when employed for such purposes." June 25, 1873.

GRANTS OF PROVISIONAL PROTECTION.

2000.—Baggs, I., High Holborn, "Improvements in the manufacture of gas and gases for illuminating and heating purposes, and in apparatus to be employed in connexion therewith." June 4, 1873.

2006.—Siemens, C. W., Great George Street, Westminster, "Improvements in apparatus for producing and regulating electric currents, such apparatus being particularly applicable for electric lighting." A communication. June 5, 1873.

2016.—Livesey, G. T., South Metropolitan Gas-Works, Old Kent Road, "Improvements in apparatus used in the manufacture of gas." June 6, 1873.

2017.—Kidd, J., Leadenhall Street, "Improvements in gas-burners." A communication. June 6, 1873.

2021.—Shanks, J., Barrhead, N.B., "Improvements in and connected with valves and waste preventive apparatus." June 6, 1873.

2047.—Hinks, J., and Holland, H., both of Birmingham, "Improvements in the manufacture of gas for heating and illuminating, and in the utilization of residual products of the said manufacture." June 9, 1873.

NOTICES TO PROCEED.

371.—Lake, W. R., Southampton Buildings, London, "Improvements in water-supply apparatus for preventing conflagrations." A communication. Jan. 30, 1873.

442.—Dean, W., Bradford, and Lancaster, R., Shelf, near Halifax, "Improvements in gas-regulators." Feb. 6, 1873.

450.—Maquay, S. W., Dublin, "Improvements in the construction of furnace-retorts, to be employed in connexion with other apparatus for the manufacture of gas. Feb. 7, 1873.

569.—Patison, J., Airdrie, N.B., "Improvements in the destructive distillation of coal and shale for the production of illuminating gas, fuel, and oil, and other products therefrom, and in the apparatus therefor." Feb. 15, 1873.

576.—Emmens, S. H., Old Jewry, London, "Improvements in apparatus for producing heat and light." Feb. 15, 1873.

591.—Henderson, A. C., Charing Cross, "Improvements in the purification of water and apparatus connected therewith, together with the mode of cleansing the same." A communication. Feb. 18, 1873.

729.—Glover, J., Seckforde Street, Clerkenwell, "Improvements in parts of dry gas-meters." Feb. 27, 1873.

798.—Tiffany, J. C., Portsmouth, U.S.A., "Improvements in means or apparatus for manufacturing and storing illuminating gas." March 5, 1873.

1099.—Blundell, T., Blundell, G. T., and Blundell, J. W., all of Limehouse, Middlesex, "Water-closets of improved construction." March 25, 1873.

Price Current.

CASTINGS.—*Per Ton.*

Average Weight of Cast-iron Gas-pipes, per Yard.

1 in.	2 in.	2½ in.	3 in.	4 in.	5 in.	6 in.	7 in.	8 in.	9 in.	10 in.	12 in.
16	21	28	33	51	70	89	107	126	149	177	208 lbs.

Retail Prices are 5 to 10 per cent. higher.	London.	Glasgow.	Newcastle and Middlesboro'.	Wales.	Yorkshire, Derbyshire, and Staffordsh.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Pig Iron, No. 1 (g.m.b.)	—	5 7 6	6 7 6	6 10 0	6 5 0
1½ and 2 inch Socket-pipes	11 0 0	10 10 0	10 10 0	10 10 0	10 10 0
2½ and 3 inch do.	10 10 0	9 15 0	9 10 0	9 15 0	9 15 0
4 and 5 inch do.	10 0 0	9 10 0	9 0 0	9 10 0	9 10 0
6 inches and upwards, do.	9 10 0	9 0 0	8 17 6	9 0 0	9 0 0
Retorts, 1st fusion, hot blast	10 10 0	9 15 0	10 15 0	9 15 0	9 15 0
Do., 2nd do., cold do.	—	—	—	—	—
Tank Plates, ¼ thick and above.	11 10 0	15 0 0	11 0 0	11 0 0	16 0 0

WROUGHT-IRON TUBES AND FITTINGS.

(Subject to 25 per cent. discount.)

Internal Diameter in Inches.	2	1½	1¼	1	¾	½
TUBES.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
Assorted, 2 to 14 feet, per foot	1 9	1 2	0 11	0 8	0 6	0 4½
Pieces, 12 to 23½ inches, each	3 6	2 0	1 8	1 4	1 0	0 9
Do., 3 to 11½ do.	2 3	1 4	1 1	0 11	0 8	0 6
Longscrews, 12 to 23½ do.	4 0	2 6	2 0	1 6	1 2	0 11
Do., 3 to 11½ do.	3 0	2 0	1 3	1 0	0 10	0 8
Bends and Lamp Bends	4 3	2 3	1 9	1 3	0 11	0 8
Springs, various elevations	3 3	1 8	1 4	0 11	0 9	0 7
FITTINGS.						
Square Elbows, equal or reducing	3 6	2 3	1 9	1 2	0 10	0 8
Round Elbows	3 10	2 6	1 11	1 4	1 0	0 9
Tees, equal or reducing	3 9	2 6	1 2	1 3	1 0	0 9
Crosses, do.	5 3	3 6	3 0	2 3	1 9	1 5
Sockets, reducing	1 3	0 11	0 9	0 7	0 6	0 5
Caps and Plugs	1 3	0 10	0 8	0 6	0 5	0 4
Nipples and Backnuts	1 0	0 8	0 6	0 4	0 3½	0 3
Sockets, plain	1 0	0 7	0 6	0 4	0 3½	0 3
Iron Main-Cocks	18 0	11 0	8 6	6 6	4 6	3 6
Syphon Boxes, 2 quarts	23 0	19 0	13 0	17 0	16 9	—

LONDON METAL MARKET.—*Per Ton.*

	£ s. d.		£ s. d.
Copper, tough cake	89 0 0	Tin, English block	138 0 0
Iron, Welsh bar	12 2 6	Tin-plates, best coke I. C.	1 14 0
Lead, English pig	23 10 0	Spelter, foreign	26 10 0

FREIGHTS.

COASTWISE.—*Per Ton.*

Newcastle—	s. d.	s. d.
Chatham and Rochester	—6	3
Cork (per keel) £13 0	0—	
Dover, Folkestone, and Ramsgate	6	3—7 0
Dublin	—	
Exeter Quay	—	
Ipswich	—	
London (from Leith)	6	3—6 4½
London (Pool)	—6	0
Lowestoft and Yarmouth	—	
Portsmouth and Southampton	7	6—8 0
Plymouth (per keel) £8 10	0—	
Shoreham	—	
Whitstable	—8	0
Weymouth	—	

FOREIGN.—*Per Keel.*

	£ s.	£ s.
Barcelona	—21	0
Bordeaux	— 9	10
Boulogne and Calais	— 7	15
Cadiz	—14	0
Cronstadt	—	
Copenhagen	—	
Genoa	—20	0
Hamburg	— 8	15
Havre de Grace	— 9	0
Leghorn	—19	0
Lisbon	—14	0
Rotterdam	— 8	0
Stettin	—	
Trieste	—20	0
Venice	—23	10

GAS COALS.—*Per Ton.*

Scotch Cannels, f.o.b.—	s. d.	*Scotch Cannels*, f.o.b.—	s. d.
Boghead, at Bo'ness	77 6	Arniston, at Leith	40 0
Capeldrae, at Burntisland	53 8	Billeyford, at Leith	26 0
Cowdenbeath, do.	—	Elphinstone Tower, do.	30 0
Donnibristle, do.	32 0	Grange Cannel, at Bridgeness	—
Kirkness, best, do.	53 8	Haywood, at Granton	—
Lesmahago (Auchin.), at Granton	46 0	Kinniel, at Bo'ness	35 0
Do. (Duke of Hamilton's), do.—		Lanemark, at Glasgow	—
Main	43 6	Lochore, at Burntisland	53 8
Wee	46 0	Myles' do.	—
Do. (Nitshill Co.'s), do., and at Glasgow	47 6	Pirnie, at Methill	26 6
Lochgelly, at Burntisland	—	Waverley Seam, at Burntisland	—
Milton and Crosshill	38 8	Old Wemyss Cannel, at Wemyss	45 0
		Wemyss Rhumes Cannel	22 6

Newcastle (Unscreened)—	Per Ton.
Haswells, Nettlesworth Primrose, and South Pelaw	—
Felling, Framwell Gate, North Pelton, Walker's Primrose, West Wear, and Whitwell Primrose	—
Burnhope, Charlaw, Derwent, East Castle, Edmondsley, Eighton Moor, Hartlepool Pelaw, Holmside, Lambton's Gas, Lanchester Pelaw, Medomsley, Mickley, New Pelaw, Pelaw Main, Pelton Main, Ravensworth, Seaham, South Moor Pelton, South Leverson, Townley Main, West Pelaw, Wearmouth Hutton, and Witton	—
Peareth, Ravensworth Pelaw, Waldridge, West Garesfield, and West Pelton	—
Brancepeth, Dean's Primrose, Londonderry Gas, New Pelton, South Peareth, Urpeth, Washington, and West Leverson	—
Ramsay's Newcastle Cannel	40 0
Wigan Cannel, f.o.b. at Liverpool	40 0

CHEMICALS.

	£ s. d.		£ s. d.
Ammonia—		Iron Salts—	
Sulphate, white and grey	17 15 0	Green and rusty Copperas	3 10 0
Do., brown, 23 per cent.	15 15 0	Dry do.	2 15 0
Benzole, 30 per cent.	0 2 3	Sulphuric Acid	3 10 0
Carbolic	0 1 3		

SUNDRIES.

	£ s. d.	£ s. d.
Best Newcastle Fire-bricks, per 1000	—	4 0 0
Do., Fire-clay Retorts, per foot run	0 7 0—	0 7 6
Cliff's Fire-bricks, at Wortley, per 1000	—	3 10 0
Ingham's best Wortley Fire-bricks, on rail or boat, per 1000	—	3 10 0
Farnley Iron Co.'s Fire-bricks, do., do.	—	3 10 0
Wortley Fire-clay Retorts, per foot run	0 5 6—	0 7 6
Tarred Rope Yarn, per cwt.	—	
Fraser's best Fire-bricks, f.o.b. at Inverkeithing	—	2 10 0
Do. Retorts, per foot run	0 5 0—	0 7 6
Do. Ground Fire-clay, per ton	—	0 10 0
Stourbridge Fire-bricks, per 1000	—	3 0 0
Do. Fire-clay, per ton	—	0 12 0

Share List

OF

Metropolitan Gas and Water Companies.

(Corrected by Mr. F. N. Golding, Sun Court, Cornhill, from the latest Stock Exchange Quotations.)

Number of Shares issued.	Amount per Share.	Name.	Amount paid up p. Share.	Dividend p. Cent. p. Annum.	Latest Quotations.
	£	GAS COMPANIES.	£ s. d.	£ s. d.	£
8000	20	Anglo-Romano	20 0 0	10 0 0	22 — 24
5000	20	Bahia (Limited)	20 0 0	3 0 0	10½ — 11½
1000	20	Do., preference	20 0 0	10 0 0	25 — 27
750	20	Do., do., redeemable	20 0 0	10 0 0	22 — 24
40000	5	Bombay (Limited)	5 0 0	6 15 0	5½ — 5¾
10000	5	Do., third issue	4 0 0	6 15 0	¼—⅜ pm.
10000	20	British (Limited) (Norwich, Hull-Sculcoates, Hanley, Tunstall & Shelton [Potteries], Trowbridge., and Holywell.)	20 0 0	10 0 0	32 — 34
7500	20	Cagliari (Limited)	20 0 0	7 0 0	15 — 16
160000	10	*Chartered* A shares	10 0 0	10 0 0	14½— 15
20000	10	Do., A	4 0 0	10 0 0	2¾—3¼ pm.
10000	10	Do., B shares, 4 per cent. max.	10 0 0	4 0 0	6¾— 7¼
25000	10	Do., 5 per cent. preference	10 0 0	5 0 0	12¾ — 12¾
20000	10	Do., 5 per cent. preference, second issue	8 0 0	5 0 0	12¼ — 12¾
20000	10	Do., 10 per cent. preference	10 0 0	10 0 0	19 — 20
12000	25	Do., D shares	25 0 0	10 0 0	48 — 49
17490	100	*Commercial*	100 0 0	10 0 0	154 —157
20000	20	Continental Union	20 0 0	8 0 0	20½— 21½
10000	20	Do., new	10 0 0	8 0 0	par—¼ pm.
10000	10	Do., new, 1872	2 10 0	8 0 0	¼ dis—¼ pm.
10000	20	Do., preference (Grmny.: Strsbg. France: Cette, Nismes, Montargis Vienne, Roanne, Beaucaire, Rueil, Albi. Italy: Milan, Genoa, Parma, Modena, Alessandria, Messina.)	20 0 0	7 0 0	24 — 26
5000	10	*Crystal Palace District*	10 0 0	10 0 0	15½— 16
5000	10	Do., preference	10 0 0	6 0 0	11½— 12
10000	10	Do., new shares	10 0 0	7 0 0	11 — 12
23406	10	European (Limited)	10 0 0	8 0 0	14¼ — 14¾
12000	10	Do., new shares (Boulogne, Amiens, Rouen, Caen, Havre, & Nantes.)	5 0 0	8 0 0	2 —2½ pm.
4054	10	Foreign and Colonial (Limited)	10 0 0	..	9¼— 10½
5000	10	Hong Kong (Limited)	10 0 0	10 0 0	13 — 13½
1560000	100	*Imperial*	100 0 0	10 0 0	159 —161
26000	12½	Do., new shares	12 10 0	7 0 0	15¼— 15¾
1300	100	Do., bonds	£100	10 0 0	195 —200
56000	50	*Imperial Continental* (Amsterdam, Berlin, Ghent, Hanover, Lille, Rotterdam., Aix-la-Chapelle, Antwerp, Bordeaux, Brussels, Cologne, Frankfort-on-Maine, Haarlem, Stolberg, Toulouse, & Vienna.)	43 15 0	9 2 6	58 — 60
3000	40	*Independent*	40 0 0	10 0 0	64 — 66
3000	10	Do.	10 0 0	5 0 0	7¼— 8½
3000	20	Do.	20 0 0	7 10 0	24½— 25½
	10	Do., D	1 0 0	..	
250000	Sk.	*London*	100 0 0	10 0 0	153 —156
£15000	Sk.	Do., 1st preference	100 0 0	6 0 0	117 —120
	Sk.	Do., 2nd preference	100 0 0	6 0 0	
	Sk.	Do., 3rd preference	100 0 0	6 0 0	
£18781	100	Do., 1st preference stock	100 0 0	6 0 0	
£11828	100	Do., 2nd preference stock	100 0 0	5 0 0	
15000	5	Malta and Mediterranean (Limited)	5 0 0	5 0 0	3 — 3½
6000	5	Do., preference	5 0 0	7 0 0	5⅝— 5¾
20000	5	Mauritius (Limited)	2 0 0	7 0 0	2 — 2¼
25000	20	Monte Video (Limited)	20 0 0	..	24 — 24½
8000	10	Nictheroy, Brazil (Limited)	10 0 0	..	2½—2 dis.
30000	5	Oriental (Calcutta)	5 0 0	9 0 0	6¾ — 7¼
30000	5	Do., new shares	2 10 0	9 0 0	¾— 1¼ pm.
10000	5	Ottoman (Limited)	5 0 0	nil.	1⅞— 2¼
17500	10	Pará (Limited)	10 0 0	7 0 0	8¼— 9¾
27000	20	*Phœnix*	20 0 0	10 0 0	31½— 32½
$600000	100	Do., new	45 0 0	7 10 0	13—15 pm.
144000	Sk.	Do.	100 0 0	5 0 0	90 — 92
5000	20	*Ratcliff*	20 0 0	10 0 0	31 — 32
34000	20	Rio de Janeiro (Limited)	20 0 0	10 0 0	35 — 37
7359	5	Singapore (Limited)	5 0 0	7 10 0	4¼— 5
2000	5	Do., preference	5 0 0	7 10 0	5½— 6
1500	52½	Shanghai	32 10 0	12 0 0	30 — 32
4000	50	*South Metropolitan*	50 0 0	10 0 0	83 — 85
4000	12½	Do.	12 10 0	10 0 0	20 — 21
20000	12½	Do., new shares	2 10 0	10 0 0	3¾—4¼ pm.
15000	10	*Surrey Consumers*	10 0 0	10 0 0	15½— 16
10000	10	Do., new	7 0 0	10 0 0	4¼— 4¾
9000	4	United General (Limerick)	4 0 0	2 10 0	1¾—2¼ pm.
1500	10	*Wandsworth and Putney*	10 0 0	10 0 0	14 — 15
1500	10	Do.	10 0 0	7 10 0	11 — 12
2957	10	Do.	10 0 0	7 0 0	
993	10	Do.	3 0 0	7 0 0	
16000	5	*West Ham*	5 0 0	10 0 0	7⅞ — 8¼
10000	5	Do., new shares	1 10 0	10 0 0	3—3¼ pm.
		WATER COMPANIES.			
60000	10	Berlin	10 0 0	11 10 0	17½— 18½
12000	100	Chelsea	100 0 0	6 0 0	117 —119
18000	100	East London	100 0 0	6 0 0	122 —124
10000	50	Grand Junction	50 0 0	8 10 0	79 — 81
5840	25	Do., ¼ shares	25 0 0	8 10 0	39 — 40
2160	25	Do., new do.; maximum dividend, 7½ per cent.	25 0 0	7 10 0	33 — 35
4396	100	Kent	100 0 0	6 0 0	121 —123
5339	100	Lambeth	100 0 0	6 5 0	121 —123
1161	100	Do.	20 0 0	6 5 0	
442	100	New River	100 0 0	8 0 0	170 —180
4443	100	Do.	20 0 0	8 0 0	36 — 38
4000	100	Do., debenture stock, 4 per cent.	100 0 0	4 0 0	96 — 98
3036	100	Southwark and Vauxhall	100 0 0	5 10 0	107 —109
1296	100	Do., preference stock	100 0 0	5 0 0	100 —102
	100	Do., D shares	100 0 0	5 10 0	102 —104
		Do., G shares	.. ..	4 10 0	
	100	Do., new ordinary	.. ..	4 10 0	
1600	100	Do., new ordinary, No. 1	40 0 0	4 10 0	
13913	61	West Middlesex	61 0 0	£6 per sh.	119 —121

DUKE OF HAMILTON'S

LESMAHAGOW GAS COAL.

LESSEES:

LESMAHAGOW AND LONGLEE COAL COMPANY,

Office—5, DIXON STREET, GLASGOW.

Works—BLACKWOOD & SOUTHFIELD, LESMAHAGOW

English and Foreign Agents:

JAMES MILLER, SON, & CO.,

9, GRACECHURCH STREET, LONDON, E.C.,

AND

75, UNION STREET, GLASGOW.

GAS MANAGER'S HANDBOOK,

BY

THOMAS NEWBIGGING, A.I.C.E.

A SECOND EDITION

OF THIS

VALUABLE WORK,

ENLARGED, IMPROVED, AND IN A MORE PORTABLE FORM,

IS NOW IN COURSE OF PREPARATION.

Orders for Advertisements to be inserted therein should be addressed to the Publisher,

WILLIAM B. KING,

11, BOLT COURT, FLEET STREET, LONDON, E.C.

BEALE'S IMPROVED PATENT GAS-EXHAUSTERS,

WITH

GWYNNE & BEALE'S

PATENT

IMPROVEMENTS,

Made under the personal superintendence of

Mr. BEALE,

The oldest Maker, Inventor and Patentee of

GAS-EXHAUSTING

MACHINERY.

It is NOT CORRECT to state that Mr. BEALE has RETIRED.

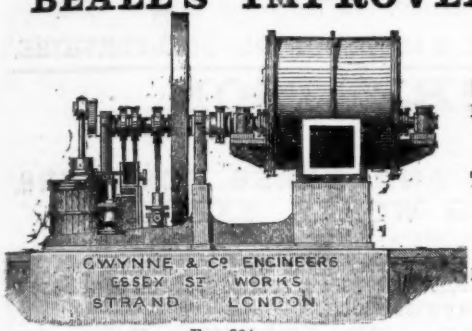


FIG. 224.

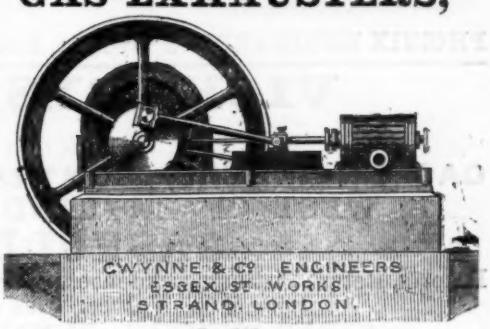


FIG. 225.

Fig. 224 represents one of those erected at the Imperial Gas-Works, Bromley, capable of passing 210,000 cubic feet of gas per hour. These Patent Machines combine the highest quality of workmanship and materials, the largest bearings and wearing surfaces, with the **most perfect system of action yet discovered.** Fig. 225 represents one of a series of four at the Nottingham Gas-Works, each passing 52,500 cubic feet per hour. GWYNNE AND Co. do not pretend to enter into a struggle with other makers in respect to **cheapness.** They have never sought to make **price the chief consideration,** but to produce Machinery of the very highest quality, and the most approved design and arrangement. Their prices have been estimated with a due regard to the **excellence of the article produced,** and when this is taken into consideration, they have no fear for the result.

The orders executed this season for Exhausters and alterations to their patented system, amount to over 3,000,000 cubic feet of gas passed per hour, and to over 200 horse power for Engines to drive them. In every instance their work is giving the greatest satisfaction.

REGULATORS, BYE-PASSES, STOP-VALVES, GAS-VALVES, & MACHINERY FOR GAS MANUFACTURE, OF ALL SIZES

CAN BE HAD ON APPLICATION TO

GWYNNE & CO., HYDRAULIC & GAS ENGINEERS, ESSEX STREET WORKS, STRAND, LONDON, W.C.

Prices and every information on application.

G. & Co. are now manufacturing for a London Gas Company two of their 210,000 cubic feet Patent Gas Exhausters.

DUKE OF HAMILTON'S

LESMAHAGOW GAS COAL.

The superior quality of this well-known Cannel, as wrought by

THE NITSHILL AND LESMAHAGOW COAL COMPANY,

Is now generally admitted by all Gas Engineers.

PRICE AND ANALYSIS MAY BE HAD ON APPLICATION TO

JAMES M'KELVIE, HAYMARKET, EDINBURGH.

HODGE & CO.'S

IMPROVED VENTILATING SUN-LIGHTS

WITH TALC REFLECTORS AND SELF-ACTING VALVES

TO PREVENT DOWN-DRAUGHT;

VENTILATING GLOBE LIGHTS for DINING-ROOMS, LIBRARIES, &c.

Ormolu, Bronze, & Crystal Gaseliers;

MEDIÆVAL CHURCH WORK AND CORONÆ;

COCKS, VALVES, and FITTINGS for GAS, STEAM, and WATER;

COLUMNS, BRACKETS, & STREET LANTERNS;

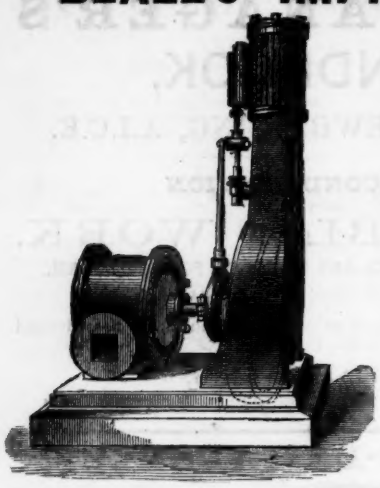
BLACK AND GALVANIZED BARREL COMPO AND TIN PIPE.

GAS ENGINEERS,

100, HATTON GARDEN, LONDON.

Drawings and Prices upon application.

BEALE'S IMPROVED PATENT GAS-EXHAUSTER

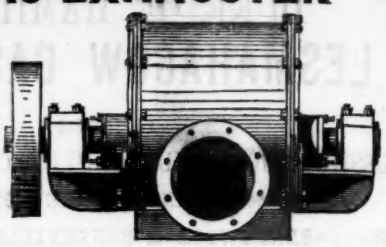


WITH

ENGINE COMBINED

ON

ONE BASE PLATE.



SOLE MAKERS,

GEORGE WALLER & CO.,

Who, since Mr. BEALE'S retirement, are the Oldest Makers.

EXHAUSTERS with HORIZONTAL ENGINE combined.
EXHAUSTERS with OUTSIDE BEARINGS.
MAKERS of ENGINES, BOILERS, and GAS MACHINERY.
TAR, LIQUOR, and SYPHON PUMPS. GAS-VALVES in stock, 2 to 30 inches.
SELF-ACTING BYE-PASS VALVES, with Lid and Relieving Lever.
MANN'S and many other descriptions of WATER DISTRIBUTORS,
SCRUBBERS, PURIFIERS, and CONDENSERS.
EXHAUSTERS from 3000 to 60,000, new and second hand, in stock.

PHŒNIX ENGINEERING WORKS, HOLLAND STREET, S.E., & at STROUD, GLOUCESTERSHIRE.

VICKARYS AND ROBERTSON,

Late JOHN VICKARY,

ESTABLISHED 1840,

GAS ENGINEERS, CONTRACTORS, IRON AND BRASS FOUNDERS,

WEST OF ENGLAND ENGINEERING WORKS, EXETER.

GASHOLDERS AND TANKS,

Retorts, Retort-Fittings, Condensers, Scrubbers, Purifiers, Station-Meters, Governors, Rack and Screw Valves. Gas and Water Mains always in Stock.

STEAM-ENGINES, EXHAUSTERS, SHAFTING AND GEARING, &c.

GAS-FITTINGS,

Including Chandeliers, Pendants, Hall Lamps, Brackets, Star and Sun Lights of all designs.

WET & DRY GAS-METERS,

Combining most recent improvements in principle and manufacture; upwards of 200,000 already in work, giving highest satisfaction.
(A guarantee of five years given with every Meter.)

PLUMBERRS WORK, including Lift and Force Pumps; Cocks for Gas and Water and Steam; Brass Fittings.

HYDRAULIC AND GENERAL ENGINEERING.

LONDON OFFICE: 8, JOHN STREET, ADELPHI, W.C.

LIVESEY FIRE-CLAY WORKS,

NEAR BLACKBURN, LANCASHIRE.

(ESTABLISHED 1835.)

ORLANDO BROTHERS,

MANUFACTURER OF PATENT CLAY RETORTS,

AND EVERY DESCRIPTION OF

TUBULAR GLAZED SEWERAGE PIPES, BENDS, JUNCTIONS, ETC.

FIRE-BRICKS, TILES, BLOCKS, AND CHIMNEY-TOPS.

WILLEY AND FORD,

GAS ENGINEERS,

WORKS: COMMERCIAL ROAD, EXETER,

INVITE THE ATTENTION OF GAS COMPANIES AND OTHERS FOR THE SUPPLY OF

EVERY DESCRIPTION OF GAS APPARATUS.

ENGINEERING DEPARTMENT.

NEW GAS-WORKS erected complete. Plans and Estimates furnished. MAINS, METERS, SERVICES, LAMPS, &c., adapted for Towns of any size. Gas Companies advised on Improvements, Extensions, and Alterations of Works.

GASHOLDERS AND TANKS.

RETORTS and RETORT-HOUSE FITTINGS, CONDENSERS, SCRUBBERS, ENGINES and EXHAUSTERS, PURIFIERS, STATION-METERS, GOVERNORS, VALVES, &c.

METER DEPARTMENT.

They beg special attention to the excellence and superiority of their WET and DRY METERS, several thousand being now in use by many of the largest Gas Companies in the West of England and South Wales. Warranted to measure correctly, and not to vary. Their acknowledged superiority has brought them into general use more rapidly than any Meters hitherto manufactured. A guarantee of Five years tendered with each Meter.

GAS-FITTING DEPARTMENT.

An extensive variety of Choice Designs in CHANDELIERS, PENDANTS, BRACKETS, STAR and SUN LIGHTS, MEDIÆVAL FITTINGS for CHURCHES, &c.

PATTERN-BOOKS and PRICE LISTS furnished.

☞ PLEASE NOTE THE ADDRESS—

GAS ENGINEERING WORKS, COMMERCIAL ROAD, EXETER.

WANTED, a Gas-Meter for about 1500 lights.
Apply, with particulars, to MELLAND AND COWARD, Heaton Mersey, near MANCHESTER.

WANTED, by the Advertiser, a re- engagement as MANAGER or FOREMAN of Gas-Works. Has had many years experience, and can give first-class references.
Address C. H., Messrs. Chandler and Son, Gas Engineers, York Street, London Road, SOUTHWARK.

METER INSPECTOR, &c.

WANTED, by the Bombay Gas Com- pany, a competent young MAN to take charge of the meters and read the indices, and lay service-pipes, &c.
Applications to be sent to the SECRETARY, stating age and salary required, not later than the 7th of July next.

WANTED, by a steady man, a situation as WORKING FOREMAN to a small Gas-Work, or FOREMAN over stokers; 12 years in present situation, and formerly in the Liverpool Gas-Works.
Apply to Mr. GUNDRY, Stone, STAFFORDSHIRE.

WANTED, a situation as Foreman STOKER, by a thoroughly practical man. Good carbonizer, having had nearly 20 years experience in one of the largest works in the kingdom. First-class reference can be given.
Apply to N. J., care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

COLCHESTER GAS COMPANY.

WANTED immediately, a Clerk in the Office of this Company. He must have a thorough knowledge of book-keeping, and be conversant with and able to make up gas and fitting accounts. He must not be under 30 years of age. Security will be required. Salary £120.
Applications, stating age and if married, to be forwarded, with references, to me by the 9th of July.
J. B. HARVEY, Chairman.
Colchester, June 30, 1873.

WANTED, a thoroughly efficient Work- ING MANAGER for a small Gas-Work in Kent. Must produce satisfactory testimonials as to character and competency.
Apply, in own handwriting, stating age, salary expected, and whether married or single, to the Clerk to the Improvement Commissioners, Milton-next-Sittingbourne, of whom all particulars may be obtained.

WANTED, a thoroughly trustworthy MAN for a small village Gas-Work. Assistance will be provided for him during the winter months, but through the summer he will have to do the whole of the work himself. He must be able to lay services and connect meters. Coals, gas, and a comfortable house with garden will be provided.
Apply, enclosing testimonials, and stating age and wages expected, to N., care of Mr. King, 11, Bolt Court, FLEET STREET, E.C,

COOKING AND HEATING BY GAS,
BY
MAGNUS OHREN, A.I.C.E.

NEW AND REVISED EDITION.

Prepared for Gas Companies to circulate amongst their gas consumers.
£1 per 100; £3 15s. per 500; or £6 per 1000.
Address, MAGNUS OHREN, Gas-Works Lower Sydenham, London, S.E.

COST PRICE SHEETS.

MANUFACTURE AND DISTRIBU- TION OF GAS. These sheets are the same as were laid before the Dublin Meeting of the British Association of Gas Managers; but in the REPRINT, NOTES have been added for the guidance of those using them. Copies of the two sheets may now be had, price 5s.
South Shields, January, 1873. W. J. WARNER.

A GENTLEMAN in the gas line, about to make a trip to Australia, is anxious to secure a few COMMISSIONS to employ his leisure time. Security if wanted.
Address I. C. U., 8, Lime Street, LONDON, E.C.

TO GAS COMPANIES.

THE Advertiser, a married man, aged 29, having had several years practical experience in the manufacture and distribution of gas, is desirous of obtaining the management of Gas-Works making from 8 to 12 million feet per annum. Good references and satisfactory reasons for leaving present situation.
Address C. L., care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

MANAGER Wanted for the Lochgil- phead Gas-Works. Consumption of gas about 2 million feet. Wages 22s. per week, with free house and garden, coal and gas, free of all rates.
Applications to be lodged before the 9th of July next with D. W. V. LAMBE, Secretary, Gas Company, who will furnish all necessary particulars.
Lochgilphead, June 19, 1873.

PUPIL WANTED.

THE Advertiser is open to take a Youth about 16 or 17 years of age as an ARTICLED PUPIL. He would have good opportunities of acquiring a thorough knowledge of the management and erection of both Gas and Water Works.
For terms, &c., apply to T. A. DREW, Engineer and Manager, Gas and Water Works, WIDNES.

TO GAS ENGINEERS, MANAGERS, ACCOUNTANTS, AND OTHERS.

THE Advertiser, having had seven years practical experience in the manufacture and distribution of gas, and all matters connected therewith, including main-laying and gas-fittings, use of test apparatus, also office work and collecting, desires a RE-ENGAGEMENT in any suitable capacity. Unexceptionable testimonials.
Address R. Y. S., care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

AN experienced Main and Service Layer is prepared to undertake the laying of mains and services (about and tools only) under contractors or companies, by the yard or job.
Address CHARLES HALL, 11, Pritchard's Road, Hackney Road, LONDON, E.

A GENTLEMAN conversant with the Continental languages, and who has had very considerable experience in the superintendence and carrying out of Railways, Mines, Gas, Water-Works, &c., is open to an ENGAGEMENT for any part of the world, either on contract or superintendence. First-class references can be given, and security if required. He was formerly an associate of the R.I.C.E. of London, and similar connexion with foreign societies.
Address COSMO, Messrs. Deacon's Advertising Agency, Leadenhall Street, LONDON.

STATION-METER FOR SALE.—Will pass 8000 feet per hour. In good condition.
Apply to Mr. MACKENZIE, Gas-Works, DUNFERMLINE.

A BARGAIN.

FOR SALE—A small Gasholder, 20 ft. by 10 ft., with columns, girders, and shifting carriages complete. To be taken down and removed by the purchaser. It is well made, in good condition, and has been in use 13 years.
Apply to the SUPERINTENDENT of the Gas-Works, Cranbrook, KENT.

FOR SALE—Two Second-hand Scrub- bers, 6 ft. in diameter and 12 ft. high. Removed to make room for larger ones. They may be erected as one Scrubber.
Also, a set of CYLINDERS for Scrubber, 4 ft. 6 in. diam.
Several small PURIFIERS of various sizes.
Eight 9-inch SLIDE-VALVES, with flanges, equal to new.
For further particulars, apply to EDWARD COCKEY AND SONS, Engineers, &c., Frome Selwood, SOMERSETSHIRE.

FOR SALE, a Set of Four Second-hand PURIFIERS, 5 ft. square, 2 ft. 6 in. deep, inlet and outlet 6 in., with 5-in. connexions; four tiers wood sieves or grids to each, hydraulic centre-valve, lifting apparatus and girders, heavy castings, and fastened with ⅜-in. angle iron. Removed to place Purifiers of larger dimensions.
For price and particulars, apply to THOS. H. BOUTTELL, Manager and Analyst, Gas-Works, SLEAFORD.

FOR SALE—Several Gas-Works com- plete, from 100 to 2000 lights.
Also PURIFIERS, 4 ft. by 2 ft. 0 in. by 2 ft. 6 in.
" 5 ft. " 2 ft. 6 in. " 2 ft. 6 in.
" 6 ft. " 3 ft. 0 in. " 2 ft. 6 in.
" 6 ft. " 4 ft. 0 in. " 2 ft. 6 in.
" 6 ft. " 6 ft. 0 in. " 3 ft. 0 in.
" 8 ft. " 8 ft. 0 in. " 3 ft. 6 in.
In stock. Can be forwarded on receipt of order.
W. C. HOLMES AND CO.
Whitestone Iron-Works, Huddersfield,
June 30, 1873.

FOR SALE—A Set of Purifiers and Condenser.
Two Purifiers, 6 ft. by 3 ft. by 2 ft. 9 in. deep.
Two do., 5 ft. by 3 ft. 8 in. by 3 ft. deep.
Four Donkin's Four-way Valves, with 6-in. connexions complete.
One Close-box Condenser, with 3 pairs of flat pipes 14 ft. high.
The above have just been replaced by larger ones, and are in perfect condition.
Apply to R. J. SKYNNER, Gas and Water-Works, MONMOUTH.

MAIRIE DE BORDEAUX.

THE Mayor gives Notice that the Light- ing by gas of the city of Bordeaux will be DISPOSED OF by public auction on the 24th of July next.
The terms of the contract may be ascertained at the SECRETARY'S Office of the Mayoralty.

TO BE DISPOSED OF, in consequence of being replaced by larger ones, about 10 tons of OVAL FLANGED PIPES, 7 in. by 5 in., 6 ft. lengths, and equal to new.
For further particulars, apply to EDWARD PRICE, Engineer to the Hampton Court Gas Company, Works, HAMPTON WICK-ON-THAMES.

TO BE DISPOSED OF, in consequence of being replaced by larger ones, a pair of 6 H.P. VERTICAL ENGINES, with oscilating cylinders, and a pair of 20,000 feet per hour Rotary Exhausters, with all valves and connexions.
Also 28 15-in. D Mouthpieces and Ascension-Pipes to suit.
The above are in good condition, and will be sold together or separately.
Apply to W. C. WATSON, Engineer, Gas-Works, KINGSTON-ON-THAMES.

THE NEW GAS COMPANY, LIMITED.

THE Directors of the above Company are ready to receive APPLICATIONS from owners of existing Gas-Works, as well as from others erecting or about to erect new works, and to grant Licences for the use of the Patents.
Apply to the SECRETARY, 22, WALBROOK, E.C.

GASHOLDER.

TENDERS for a two-lift Gasholder, 79½ ft. diameter, will be received up to the 20th of July, at the address below, where drawings and specifications can be seen.
The undersigned does not engage to accept the lowest or any tender. LOUIS WILDE,
Agent for the Buenos Ayres Gas Company.
4, Cable Street, Liverpool, June, 1873.

TO TAR DISTILLERS.

THE Directors of the Independent Gas- light and Coke Company are prepared to receive TENDERS for the TAR produced at their works, at Haggerston, for One year, from the 31st of July, 1873.
Tenders to be sent to me, on or before Thursday, the 3rd day of July, endorsed "Tender for Tar."
The Directors do not bind themselves to accept the highest or any tender.—By order,
JAMES B. COULSON, Secretary.
236, Kingsland Road, June 13, 1873.

TENDERS FOR GAS COALS.

THE Directors of the Canterbury Gas and Water Company invite TENDERS for the supply of 3000 tons of best GAS COAL, to be delivered as follows:
400 tons during the month of August next.
500 " " " September "
500 " " " November "
500 " " " December "
600 " " " January, 1874.
500 " " " February "
Persons tendering to state the name and description of the Coal proposed to be supplied, and a price per ton either free on board or delivered into the Company's Gas-Works.
Tenders, endorsed "Tender for Gas Coal," to be addressed to me, and delivered at the Company's Offices, Castle Street, Canterbury, before Ten o'clock in the forenoon of Friday, the 11th of July next.
The Directors do not bind themselves to accept the lowest or any tender.—By order,
June 28, 1873. JAMES BURCH, Secretary.

THE BOMBAY GAS COMPANY, LIMITED.

THE Directors of this Company invite TENDERS for the purchase, in whole or in part, of a large quantity of surplus Brass and Iron GAS FITTINGS, consisting principally of
Union Cocks.
" with tinned ends.
" Elbows.
Caps and Linings.
Ceiling Plates.
Universal Joints (brass to join iron).
Bracket Backs for Brass.
Cone Joints. [backs.
Brass Nose Ends and Nose Pieces, with wing
Tinned-end Ground Unions.
Iron Pillar Cocks.
Iron Pendant Tops.
Brass Swivels, &c., &c., &c.
In accordance with a specification to be had at the Offices of the Company, where samples may be seen and lists obtained, any day between the hours of 11 and 4 o'clock.
Tenders to be endorsed "Tenders for Fittings," and addressed to the Secretary on or before Monday, July 7, 1873.
The Directors reserve the right of either accepting or rejecting the whole or any portion of any Tender.
WM. MARSHALL, Secretary.
4, Great Winchester Street Buildings,
London, June 14, 1873.

CAST-IRON SOCKET-PIPES FOR WATER OR GAS.

THOMAS ALLAN AND SONS,
SPRINGBANK IRON-WORKS, GLASGOW,
Have FOR SALE at their branch works, South Stockton-on-Tees, the following PIPES of superior quality, all proved to 300 feet:—

Size.	Length.	Weight per Pipe. Cwt. qr. lb.	Quantity.
1¼ in. ..	6 ft. ..	0 1 2 ..	1000 pipes.
2 " ..	6 " ..	0 1 14 ..	2000 "
3 " ..	9 " ..	0 3 14 ..	4500 "
3 " ..	9 " ..	0 3 21 ..	550 "
4 " ..	9 " ..	1 1 14 ..	3500 "
5 " ..	9 " ..	1 3 14 ..	300 "
6 " ..	9 " ..	2 1 14 ..	100 "

For terms address THOMAS ALLAN AND SONS, GLASGOW.
June 9, 1873.

TORBANEHILL MINERAL.

For Sale, by Tender,

FOR WHOLE OR PART,

SEVERAL THOUSAND TONS OF THE

Celebrated Torbanehill Mineral,

Saved from the fire at Torbanehill in June last.

The mineral as it at present lies has been examined and analyzed by Dr. WILLIAM WALLACE, Analytical Chemist, Glasgow, who says:
"Very great care was employed to obtain reliable average samples, and the results show that the mineral is not appreciably damaged."
The results of two testings of fair samples of the Coal give 14,680 cubic feet of 43·7 candle gas.

APPLY TO

MR. DAVID STEWART,
128, INGRAM STREET, GLASGOW.

In the Press, and will shortly be published,

THE GAS CONSUMER'S MANUAL;

Or, How to obtain Cheap Gas and Good Light.

Being a Popular Exposition of the Chemistry of Gas Lighting, with Practical Instructions in the best methods of burning Gas for Lighting, Cooking, and Heating; also Hints as to the proper Sizes of Interior Pipes and Fittings, and Arrangement of Lights, &c., &c. Illustrated.

ALSO,

ON SETTING AND WORKING RETORTS.

A Revised and Illustrated Reprint of a Paper read at the Annual Meeting of the British Association of Gas Managers in 1870.

By E. S. CATHELS, Assoc. Inst. C.E., MONTREAL, CANADA.

SIDNEY LEONI & CO.,

19, GREAT GEORGE STREET, WESTMINSTER, S.W.,

AND

ADAMAS WORKS, ST. PAUL STREET, NEW NORTH ROAD, N.,

MANUFACTURERS OF

GAS AND HOT WATER APPARATUS,

AND OF THE WELL-KNOWN

PATENT ADAMAS GAS-BURNERS.

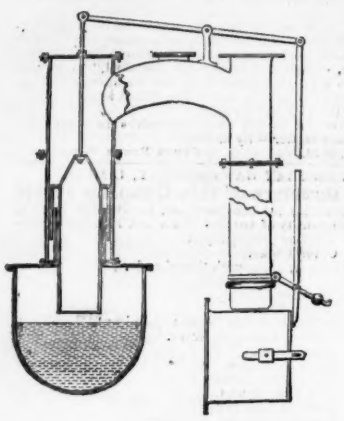
A LARGE STOCK OF ALL KIND FOR FAMILY USE ALWAYS READY.

They have fitted up Cooking Apparatus in large Establishments, where savings of £300 per annum have been effected.

See "Report of the London Hospital," JOURNAL OF GAS LIGHTING, *Aug.* 13, 1872, *No.* 517.

ESTIMATES ON APPLICATION.

CHANDLER'S PATENT DIP-PIPE.



It is well known by all Gas Managers that back pressure upon the retorts greatly retards the production of gas, causing a deposit of carbon which keeps steadily accumulating. Such carbon reduces the capacity of the retorts, requires extra fuel for heating, and has to be frequently removed by heavy iron bars, which very much injure the retorts. By the use of Chandler's Patent Dip all these evils are entirely remedied. When the retorts are being drawn and charged, the Dip-Pipe is sealed in the fluid of the hydraulic main. As soon as the lids are replaced, the Dip is raised completely out of the fluid, and the gas passes unrestricted to the holders. By running the exhauster to a level gauge, ALL PRESSURE IS REMOVED FROM THE RETORTS. The consequence is that there is no deposit of carbon, no need of scurfing, no extra fuel is required, a large saving of wear and tear and loss of time is effected, and a greatly increased production of gas per ton of coal is realized.

The manager of the Erith Gas-Works has used the Patent Dip-Pipe to a single retort for some months, with complete success in regard to all the advantages mentioned, and has now ordered the patent to be applied to other retorts. He has kindly consented to reply to any inquiries that may be addressed to him. [See notice in JOURNAL OF GAS LIGHTING, page 413, May 6, 1873.] The Patent Dip-Pipe is also ordered for trial in several other places.

For terms of use and cost, apply only to the Patentees,

Messrs. CHANDLER & SONS, YORK STREET, LONDON ROAD, SOUTHWARK, LONDON, S.E.

EDWARD COCKEY & SONS,

ENGINEERS, IRONFOUNDERS, & CONTRACTORS,

FROME SELWOOD, SOMERSETSHIRE

MANUFACTURERS OF

GASHOLDERS, PURIFIERS, CONDENSERS, SCRUBBERS;

ALSO OF

STEAM-ENGINES, EXHAUSTERS, IMPROVED PUMPS FOR TAR AND LIQUOR,

SLIDE-VALVES,

AND ALL DESCRIPTIONS OF APPARATUS USED IN GAS-WORKS.

PATENTEES AND MANUFACTURERS OF THE

DRY-FACED CENTRE-VALVES,

Which are now so extensively used.

During the last year these Valves have been introduced into some of the large gas-works in London, where they are giving the greatest satisfaction. Favourable reports have been received from the engineers of these and of some of the most important works in the kingdom. The demand for them both for home and foreign works continues unabated.

Every Valve is made with covering bars, to protect ALL the faces. The Patentees found the necessity for this almost immediately after they commenced the manufacture of these Valves, and they have ever since adopted the practice. The large experience they have gained has also enabled them to introduce several minor improvements in the construction of their Valves. It is an advantage peculiar to these Valves that the covers can be easily raised, the faces cleaned and oiled, and kept in perfect condition. If managers of gas-works will periodically attend to this, the Valves will be as good after twenty years use as when first put in.

Messrs. COCKEY AND SONS have been very successful in the erection of many gasholders, some of very large size. They erected, in 1871, at Dublin, for the Alliance Gas Company, one of the largest in the kingdom; telescopic, 182 feet 6 inches diameter. It was referred to by the Chairman of that Company the following year, in his report to the shareholders, as having been in use, and working most effectively, since its erection, and being in the highest degree satisfactory to the Company.

Plans of gas-works are carefully prepared, and every improvement which long practical experience can give is introduced into works entrusted to the care of the Advertisers.

References can be given to the Directors of many Companies who have placed works in their hands, and who will testify to the satisfactory results of so doing.

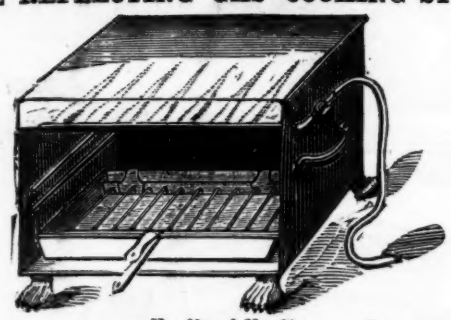
JOHN WRIGHT & CO.,

ESSEX WORKS—30, BROAD STREET, ISLINGTON, BIRMINGHAM.

A DISCOUNT TO THE TRADE OFF THESE PRICES.

JOHN WRIGHT & CO. respectfully submit some few of their New Designs of Gas Cooking and Boiling Stoves, and will be happy to send more particulars, with Trade Discount, on application. The high price of Coals has very considerably quickened the demand for Gas Stoves, and J. W. & Co. respectfully therefore solicit early orders from their friends, which shall always have their prompt attention. Many Gas Companies have adopted the plan of letting out Gas Stoves on Hire, and found a greatly increased consumption of Gas in the summer time, to their own profit and the convenience of the consumers. JOHN WRIGHT & CO. will be glad to send one of their New Pattern Books on application.

THE REFLECTING GAS COOKING STOVE.

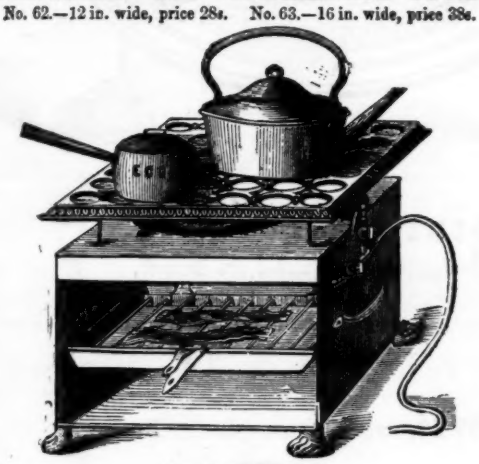


No. 60 and No. 61.

No. 60.—Size, 12 in. wide and 8 in. high, 16s. No. 61.—Size, 16 in. wide, 23s. 6d. Broils Chops, Steaks, or Bacon, and Toasts Bread, by reflected heat, in the most perfect manner.

REFLECTING GAS BREAKFAST COOKER.

No. 62.—12 in. wide, price 28s. No. 63.—16 in. wide, price 33s.

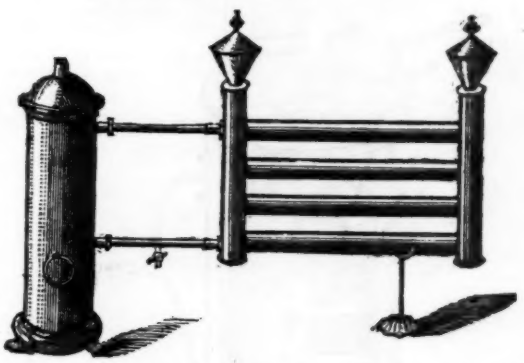


No. 62 and No. 63.

This Breakfast Cooker will Boil a Kettle, Boil Eggs, Toast Bacon or Bread, at a cost under One Farthing for Gas. The Kettle or Saucepan can be placed more or less over the burner, so as to make it boil quickly or keep it only on the simmer.

CHEAP HOT-WATER APPARATUS,

Heated by Gas, for Small Conservatories, Coach Houses, &c.



No. 78.—2 ft. between uprights, £3. No. 79.—4 ft. between uprights, £3 14s.

ROUND GAS COOKER.

ROUND GAS COOKER.

No. 69.

This is made to meet a demand for a very cheap Cooker by Gas. It is 14 in. diameter, and will Roast and Bake at the same time. Price 28s.

No. 56. Price £5.

THE REFLECTOR GAS COOKING STOVE,

By which Joints, Poultry, &c., can be Roasted as before an open Coal Fire.

Size—18 in. wide, 12 in. deep, 30 in. high.

The Top Boiling Hot Plate is 20 in. wide, and 15 in. deep.

In this New Apparatus the jets of gas are placed above the meat, and under a powerful Radiator, which throws down a great amount of heat. The meat is therefore roasted as by an open fire. The heat escapes into an outer case surrounding the oven, and not into the oven itself, and consequently no products of combustion come in contact with the article baking.

It is made especially to meet the demand for an Economical Gas Cooking Apparatus, and every particle of the heat is utilized. As shown in the engraving, Roasting, Baking, Boiling, Grilling, and Toasting, may all be carried on simultaneously.

The Roasting, Grilling, and Toasting are done *under the burner*, while the oven above the roasting flame receives the heat from it for Baking. The double body of the Oven economizes and equalizes the heat.

A joint of 9 lbs. or 10 lbs., a pair of ducks, a large family pie, two sorts of vegetables can be steamed, fish and soup, all can be done exactly, without ouble, smoke, or dirt, for a cost of TWOPENCE.

JOHN WRIGHT & CO., Essex Works, 30, Broad St., Islington, Birmingham.

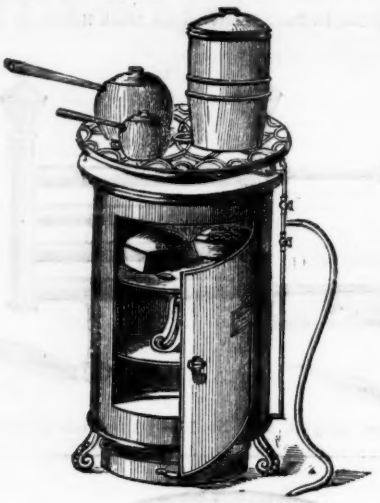
NEW PATTERN BOOK WITH TRADE PRICES SENT ON APPLICATION.

ROUND GAS COOKER,

Showing Steamer and Two Saucepans in use on top, and a Joint of Meat and Two Pies baking inside.

This new Gas Stove has a large atmosphere ring burner, and an open-work Hot Plate on top. This is a very great improvement, and enables a Saucepan or Steamer to be placed wholly over the burner, or to be partly removed so as to be kept simmering. With one of these Cookers and one of our Round Steamers a dinner can be cooked for twelve persons at a cost of less than 2d. for gas.

This Stove is shown roasting a joint of meat and baking two pies, a pair of fowls are being cooked in the steamer, while vegetables and a pudding are also steaming in the top division of the steamer; two saucepans are also boiling, and the whole does not cost 1d. per hour for gas.



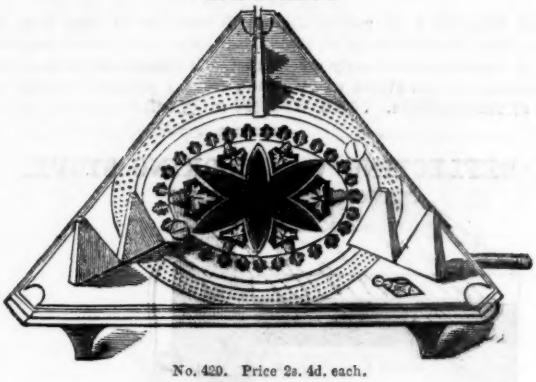
No. 67.

Is made 14 in. diameter, with a 16 in. Hot Plate.

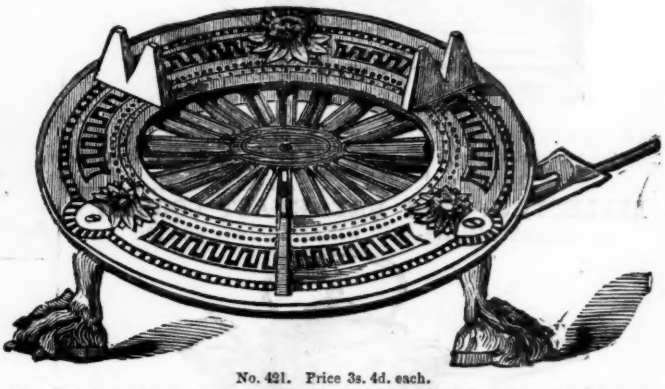
Price of Gas Stove, without Saucepan or Steamer, £2 10s.

NEW PATTERN REGISTERED GAS STOVE,

Best Bronzed.



No. 420. Price 2s. 4d. each.



No. 421. Price 3s. 4d. each.

These Stoves are made on a new principle, and combine the advantages of all other Gas Stoves.

No. 51.

BOILING STOVE,

With Iron Reflecting Plate under the Burner,

No. 51.

This is a very useful and powerful Gas Stove, with a Ring Burner, neat in appearance, handy in use, and very effective.

Price 7s. 6d.

IMPROVED SQUARE GAS COOKING STOVES, with Atmospheric Burners.

No. 64.

With Cast-Iron Top and Bottom, and Stout Plate-Glass Door.

18 in. square, with Two Small Boiling Stoves and One Large Boiling and Broiling Stove, with Heat Reflector. Top Boiling Plate 21½ in. square, **£6 6s.**

24 in. square, with Two Folding Doors, Two Small Stoves, and One Large Boiling and Broiling Stove, with Heat Reflector. Top Boiling Plate 26½ in. square, **£8 8s.**

No. 65.

With Cast-Iron Top and Bottom, and Stout Plate-Glass Door.

14 in. square, with 16 in. Top Plate, with One Small Boiling Stove on the Top, **£3 16s 8d.**

16 in. sq., with 18 in. Top Plate, with One Boiling and Broiling Stove on the Top, **£5.**

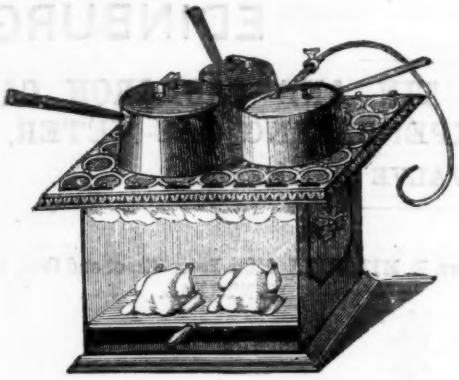
18 in. square, with 20 in. Top Plate, with Two Small Boiling Stoves and One Large Boiling and Broiling Stove on the Top (as engraving), **£5 15s.**

JOHN WRIGHT & CO., Essex Works, 30, Broad St., Islington, Birmingham.

NEW PATTERN BOOK WITH TRADE PRICES SENT ON APPLICATION.

REGISTERED GAS COOKER,

For Boiling, Broiling, and Toasting.



No. 28—Top Plate 19 × 17 in., £2 10 0

No. 38—Top Plate 19 × 22 in., £3 9 6

This Stove effectually and economically boils three or four Saucepans, and cooks (by reflection) Chops, Steaks, a small Joint, or pair of Fowls. It also makes Toast, and acts very nicely as a Salamander.

As the heat can be regulated to the greatest nicety, it is highly recommended for making Preserves, Stews, or anything requiring gentle boiling. It is a most useful apparatus in any kitchen, and in large establishments will be found a very valuable auxiliary.

REGISTERED PORCELAIN BROILER.

No. 48—Top Plate 15 in. square, 12 in. high, £3 0 0

Will cook a Fowl, or toast Bacon, a Chop, Steak, or Bread inside, and boil three or four Saucepans on the top.

REGISTERED PORTABLE HOT PLATE, HEATED BY GAS.

No. 336—20 in. long, 10 in. wide, 4 in. high, £1 0 0

This is a most useful article in any Kitchen.

PORCELAIN GAS COOKING APPARATUS,

Are formed of thick White Porcelain Tiles, set in a strong and neat Iron Frame, and are the most cleanly and perfect Stoves made.

No. 140 (*as engraving*)—With two Boiling Stoves and one Broiling and Boiling Stove on top.

Size of Stove	18 × 20 in.
Size of Top Boiling Frame	20 × 22 in.
Height	3 feet.

Price £9 11 6

No. 142—Has three Boiling Stoves and one Broiling and Boiling Stove on the top.

Size of Stove	28 × 20 in.
Size of Top Boiling Frame	30 × 24 in.
Height	3 feet.

Price £16 0 0

No. 144—Has four Boiling Stoves and two Broiling and Boiling Stoves on the top, and two Folding Doors.

Size of Stove	30 × 20 in.
Size of Top Boiling Frame	40 × 24 in.
Height	3 feet.

Price £21 0 0

GAS STOVES FOR BOILING AND BROILING.

Fig. 1 shows the No. 6 or No. 7 Stove in use with a Steamer Cooking a Leg of Mutton, Vegetables, and a Pudding above the flame, and Roasting a Fowl underneath.

Fig. 2 shows the No. 6 or No. 7 Stove with a Chop or Steak broiling under, and Potatoes baking in the Fire-Clay Oven over the Stove.

Fig. 3 shows the Stove as adapted for Boiling only, with the Heat Reflector placed under the Stove, and reflecting all the heat on to the Saucepan or Tea Kettle.

Fig. 1.

Fig. 2.

Fig. 3.

No. 6 Stove, with two Reflectors, Gridiron, and Frying Pan complete, 9 in. diameter, **16s. 6d.** complete.
No. 7. do. do. do. do. 11 in. do. **20s. 6d.** do.

COMMON BOILING GAS STOVES from 1s. 6d. each upwards.

WILLIAM & BENJAMIN COWAN,

ESTABLISHED 1827,

KING HENRY'S WALK,
BALLS POND ROAD,
(NEAR DALSTON JUNCTION STATION,) **LONDON, N.**

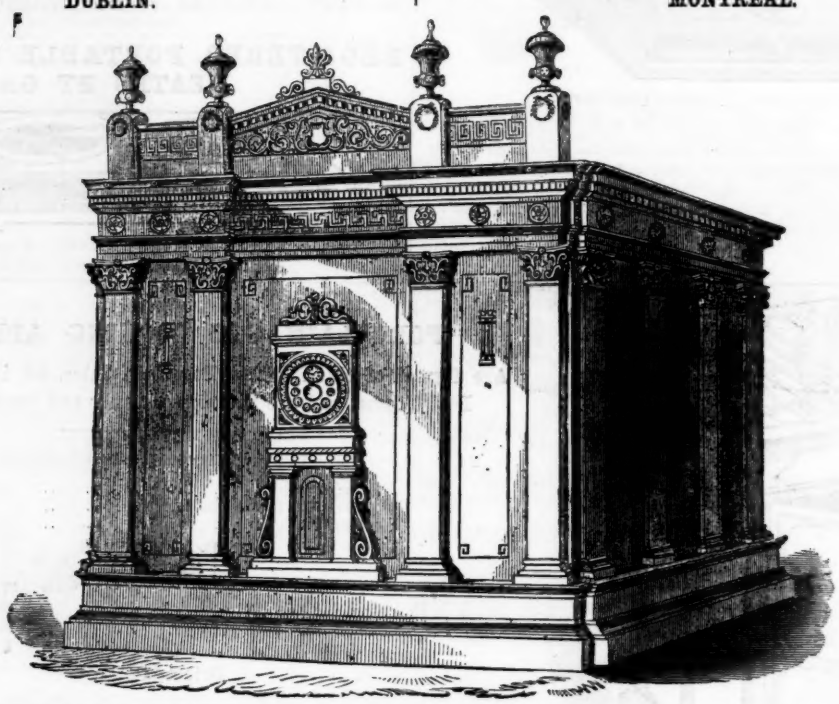
BUCCLEUCH ST. WORKS,
EDINBURGH.

Manufacturers of DRY GAS-METERS in TIN AND CAST-IRON CASES.
Sole Manufacturers of ESSON'S PATENT COMPENSATING GAS-METER,
AND OF **COWAN'S PATENT SIDE-VALVE GAS-METER.**

AGENTS.

Messrs. J. EDMUNDSON & Co., 36, Capel Street, DUBLIN.

Messrs. R. MITCHELL & Co., Peter Street and Craig Street, MONTREAL.



W. & B. COWAN'S SQUARE STATION-METER with PLANED JOINTS.

GOVERNORS, PRESSURE REGISTERS, TEST GASHOLDERS, GAUGES, &c.
WET AND DRY METERS SPECIALLY MANUFACTURED FOR STREET-LAMPS.

PRICE LISTS ON APPLICATION.

Mr. ALFRED LASS,
60, CORNHILL, LONDON, E.C.,
Is prepared to open the Books, and, if necessary, keep the Accounts of Gas and Water Companies.
To examine the Books and Accounts, and prepare Balance-Sheets for the information of Directors.
To assist Secretaries in preparing Balance-Sheets, according to the "Gas-Works Clauses Act, 1871;" or may be consulted with respect to Accounts generally.

SAMUEL PONTIFEX, Consulting Gas Engineer, having retired from the Great Central Gas Company, is now prepared to furnish PLANS and SPECIFICATIONS, as well as ADVISE Provincial Gas Companies as to the erection of new, or alteration and enlargement of existing works.
Offices: 22, Coleman Street, LONDON, E.C.

J. T. B. PORTER & A. SILVERTHORNE, C.E., 1, Westminster Chambers, LONDON, S.W., Consulting Engineers.
Corporations and Companies advised on all matters connected with Gas and Water Works.

BIRTLEY IRON WORKS,
CHESTER-LE-STREET, DURHAM.
Manufactory for every description of Casting and Machinery for Gas-Works and Water-Works.
Warehouse in London for Cast-Iron Pipes and Connexions of all sizes and in any quantity, Scott's Wharf, Bankside, Southwark.
Agent in London, Mr. J. MANWARING, 101 Cannon Street E.C.

WILLIAM BRODIE & CO.,
GAS ENGINEERS,
MANUFACTURERS AND CONTRACTORS FOR
GAS APPARATUS, GASHOLDERS, TANKS, VALVES, IRON ROOFS, GIRDERS, BRIDGES, &c.,
CALEDONIA IRON-WORKS, PAISLEY.

Attention is requested to
BRODIE'S IMPROVED GAS APPARATUS,
Admitted to be the best and most economical for lighting factories, railway stations, mansions, country houses, and other isolated buildings.

FIRE-CLAY RETORTS.
WILLIAM FRASER,
INVERKEITHING,
(Owner of the Works at which Fire-Clay Retorts were first made), can supply
RETORTS, FIRE-BRICKS, &c., to any extent.
References can be given to managers of above a hundred Gas-Works whom he supplies.
He ships at Charlestown his
CELEBRATED HALBEATH STEAM COALS, on Navy List.

REMOVAL.
MR. ALFRED PENNY, C.E., begs to give notice that he has REMOVED his Offices from the Wenlock Iron-Works to No. 20, ABINGDON STREET, WESTMINSTER, where he may be consulted as usual on all matters connected with Gas-Works, Water-Works, and Drainage, both for England and Abroad.

THE PATENT RIBBED GAS RETORTS are strongly recommended for their efficiency and great durability. They are in use at above 150 Gas-Works.
Illustrated circular, testimonials, and prices, will be forwarded on application to
A. C. FRASER,
PATENT GAS COMPANY, GAS-WORKS, NEW BARNET, HERTS.

OXIDE OF IRON.—We are prepared to supply, on moderate terms
HYDRATED PEROXIDE OF IRON (BOG OCHRE),
Same quality as supplied by us to several of the most extensive Gas Companies, and which has given entire satisfaction.
FRANCIS RITCHIE & SONS,
BELFAST.

E. GODDARD,
GAS-WORKS, IPSWICH
SOLE AGENT FOR
EDGE'S PATENT
FOR REMOVING THE
CARBONACEOUS INCRUSTATION FROM GAS-RETORTS.

JAMES MILNE & SON,

GAS ENGINEERS,

Gas-Meter, Gas Apparatus, and Gas-Fittings Manufacturers,

EDINBURGH, AND

2, KING EDWARD STREET,

NEWGATE STREET, LONDON.

STATION-METERS, GOVERNORS, CONSUMERS METERS, GAS LUSTRES, CHANDELIERS, BRACKETS, &c.,

And every description of Gas-Fittings and Gas Apparatus.

SCHOLL'S

PATENT PLATINUM

GASLIGHT PERFECTER.

Extract from Report by Dr. Letheby:—

"The results have been very remarkable, for they show an average increase of 63 per cent. on the illuminating power of the gas. I am of opinion, therefore, that the invention is of great practical value."

Extract from Dr. Frankland's Course of Lectures at the Royal School of Mines, February, 1868.

"Scholl's Platinum Perfecter is one of the most important inventions of modern times in connexion with the burning of coal gas."

Price 1s. each for Fishtail Burners.

To be had retail of Gas-Fitters and Ironmongers.

JOHN SCHOLL, Manufactory: 41 & 42, BERWICK STREET;

Retail Depot: 198a, OXFORD STREET, LONDON, W.

Terms on application. N.B.—A specimen sent free on receipt of Twelve stamps.

*** Farther testimonials from Drs. Frankland and Crooks, showing the great practical value of this invention, will be shortly published.

CANNEL COAL.

ELLIS LEVER & CO.,

GAS COAL MERCHANTS,

107, PICCADILLY, MANCHESTER.

ALL CLASSES OF

ENGLISH, SCOTCH, & WELSH CANNEL COALS.

SAM. CUTLER & SONS,

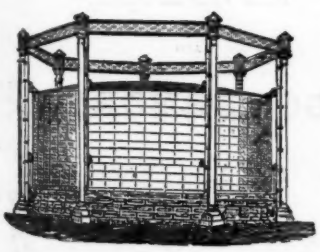
CONTRACTING GAS ENGINEERS,

GASHOLDER & GENERAL GAS APPARATUS MAKERS,

MANUFACTURERS OF

BOILERS, IRON ROOFING, IRON BRIDGES,

AND GENERAL IRONWORK.



S. C. AND SONS undertake Contracts of any magnitude for the **Erection of new and Remodelling of existing Gas-Works**, for **Gasholders, Cast and Wrought Iron Tanks, Iron Roofs**, and every description of **Apparatus** for the Manufacture and Distribution of Gas.

Special attention is invited to their **"Improved Condenser,"** which is very effective, and much approved; also to their patterns of **Annular** and other **Condensers, Scrubbers**, and **Purifiers**, of all sizes, which they arrange either with **Centre** or Ordinary **Slide Valves.**

WORKS FOR THE SUPPLY OF

VILLAGES, MANSIONS, FACTORIES, &c.

S. C. AND SONS undertake the **Supply** and **Laying** of **Mains** for **Gas and Water**, and supply all Castings, Connexions, and Fittings for Retort-House, Works generally, and for Streets. They also supply **Valves** of all descriptions, Iron and Clay Retorts, Hotpressed Retort-Lids, Steel Charging-Scoops of improved make, for which they have special machinery, Improved Coke and Coal Barrows, Cross-Bars and Screws, Bolts and Nuts, Furnace and Stoking Tools, Iron and Wood Purifier-Sieves, Lead, Yarn, Borings, &c., including every requisite whatsoever for a Gas-Work, a well-assorted stock being kept of those goods most in request.

SOLE MAKERS OF BRETT'S PATENT COKE BARROW.

Experienced Retort Setters sent to any part of the Kingdom.

Address: **PROVIDENCE IRON-WORKS, MILLWALL, LONDON.**

B. CARPENTER'S

IMPROVED WOOD SIEVES

FOR

GAS PURIFIERS & SCRUBBERS.

WORKS:

22, HERMES STREET, PENTONVILLE ROAD,

LONDON, N.

The above Sieves are used by all the Gas Companies in London and a great many in the country. Their utility, durability, and cheapness combined, render them superior to all others.

Testimonials from Gas Engineers who have tested their qualities forwarded on application.

All orders punctually attended to, and estimates given if required.

INTERNATIONAL EXHIBITION, 1862.

CLASS X.

PRIZE MEDAL

For excellence of Fire-Clay Gas Retorts, and "HONOURABLE MENTION" for good quality of Fire-Bricks.

WILLIAM STEPHENSON & SONS,

THROCKLEY,

NEWCASTLE-ON-TYNE.

BRONNER'S PATENT GAS-BURNERS give 99 per cent. of light, as compared with 27 per cent. given by ordinary burners, with equal consumption of gas.—*Vide* "Gas Referees Report," published June, 1869.

HENRY GREENE AND SON, Sole Consignees of Brönner's Patent Improvements in Gas Lighting, 16 and 17, King William Street, LONDON, E.C.

BELGIAN CLAY RETORTS.

J. SUGG and CO., late ALBERT KELLER, GHENT.—The removal of the import duties on Earthenware permitting the entry of Clay Retorts into England, Messrs. Sugg, of Ghent, beg to draw the attention of the Gas Companies of London, and other Cities, to the very superior quality of the RETORTS manufactured by them. They can be made of any size, in one piece, and of any form. The price will be in proportion to the weight, and very moderate in comparison to their value.

Communications addressed to J. SUGG & CO., GHENT, will receive immediate attention.

CATHELS & TERRACE'S Patent Four-WAY DISC GAS-VALVE is the simplest and best Valve for Purifiers, and as a By-pass for other apparatus in Gas-Works. It is always gas-tight, and has no springs, ground faces, or other delicate parts. By its use the flow of the gas cannot be accidentally stopped, and it never sticks.

For prices, &c., apply to the Manufacturers, Messrs. GUEST AND CHRIMES, Foundry and Brass Works, ROTHERHAM.

CATHELS'S Patent District Dry Gas-GOVERNOR is the only perfect self-acting contrivance for Regulating the Pressures in the higher levels of a district.

For prices, &c., apply to the Manufacturers, Messrs. GUEST AND CHRIMES, ROTHERHAM.

ADDISON POTTER,

WILLINGTON QUAY,

NEAR NEWCASTLE-UPON-TYNE,

Manufacturer of Clay Retorts, Fire-Bricks and every description of Fire-Clay Goods.

CLAYTON'S PATENT SIX-WAY VALVE only requires one valve to work two purifiers; saves more than three-fourths of the connexion-pipes; requires neither tees, elbows, nor bends; no racks or springs to get out of order.

For particulars, apply to CLAYTON, SON, & Co., Gas Engineers, Hunslet, LEEDS.

TO GAS COMPANIES, ENGINEERS, &c.

WOOD SIEVES.—WOOD SIEVES.

Estimates given and Contracts taken by the Manufacturer

GEORGE MACKANESS,

36, EDWARD STREET, HAMPSTEAD ROAD,

LONDON, N.W.

These Sieves are made with parallel or bevel bar, and guaranteed to be well seasoned yellow deal, and not common spruce so generally used.

N.B.—Specimens sent free on application.

JAMES OAKES & CO.,

ALFRETON IRON-WORKS, DERBYSHIRE,

AND

WENLOCK IRON WHARF, 20 & 22, WHARF ROAD, CITY ROAD, LONDON, N.,

Beg to inform Gas and Water Companies and the public, that they keep in stock in London all the CASTINGS in general use in Gas and Water Works, including Iron Retorts, Socket and Flange Pipes, Bends, Branches, and Syphons of all sizes, Lamp Columns, &c., &c.

N.B.—Orders for Cast-Iron Tanks, Girders, Columns, Cylinders, and all irregular castings, will have immediate attention. CHARLES HORSLEY, Agent.

ALEXANDER F. PAINTER,

CONTRACTING ENGINEER

FOR

GAS & WATER WORKS,

GREAT BERKHAMPSTEAD, HERTS.

Foreign Orders carefully executed. Provincial Gas-Works designed and erected. Extensions of Works carried out with despatch. Mains supplied and promptly laid. Public and Private Buildings fitted up. Gasholders, Purifier Covers, and all Sheet Ironwork. Wrought Ironwork to drawing.

Specifications, Estimates, and Tenders given.

GAS-WORKS LEASED.

THE IMPERIAL METER COMPANY, LIMITED,

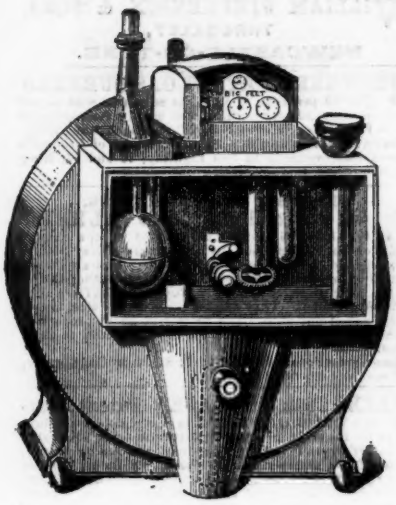
MANUFACTURERS OF

WET AND DRY GAS-METERS,

PRESSURE-GAUGES AND GOVERNORS, AND STREET-LAMP REGULATORS.

FACTORIES:

KING'S ROAD, LONDON, N.W., and GRAY'S INN ROAD, LONDON, W.C.



Front View.

THE

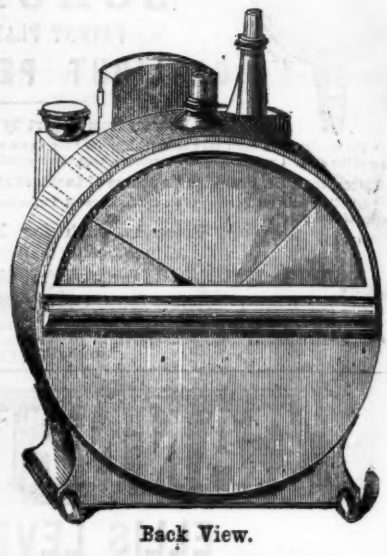
IMPERIAL

COMPENSATING

WET GAS-METER.

DE CASTRO & BURTON'S

PATENT.



Back View.

I. **This Meter is more simple in construction than the common non-compensating Meter.**
II. **An unvarying water-line is maintained.**
III. **No amount or kind of pressure will cause it to "flood."**
IV. **It is practically unaffected by "tilting."**
V. **The friction is less than in any other Meter; and**
VI. **It will last for twelve months without requiring to be refilled.**

THE IMPERIAL METER COMPANY, LIMITED, ALSO MANUFACTURE COMMON NON-COMPENSATING WET GAS-METERS OF ALL SIZES, BOTH IN TIN AND CAST-IRON CASES.

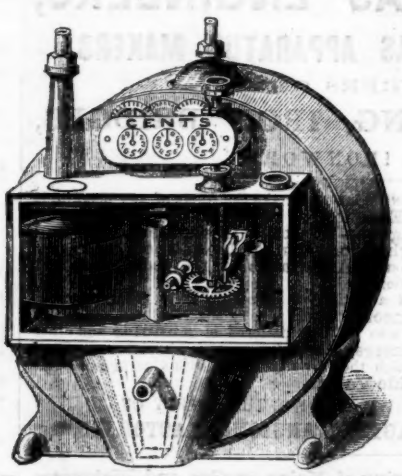
THE COMPENSATING

WET GAS-METER

IS UPHELD FOR

TEN YEARS

WITHOUT CHARGE.



THE IMPERIAL WET GAS-METER.
Non-Compensator.

STATION-METERS

WITH PLANED JOINTS,

AND

GOVERNORS,

MADE TO ORDER.

Mr. GEORGE MACKANESS will represent this Company in the Provinces.

OFFICES: 41, FLEET STREET, LONDON, E.C.

W. MOORE, Secretary.

☞ *All Communications to be addressed to the Secretary.*

THE IMPERIAL METER COMPANY, LIMITED,

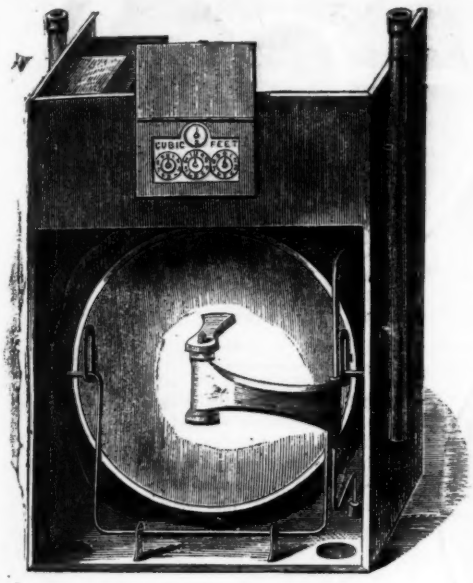
MANUFACTURERS OF

WET AND DRY GAS-METERS,

PRESSURE-GAUGES AND GOVERNORS, AND STREET-LAMP REGULATORS.

FACTORIES:

KING'S ROAD, LONDON, N.W., and GRAY'S INN ROAD, LONDON, W.C.



Front View.

THE

IMPERIAL

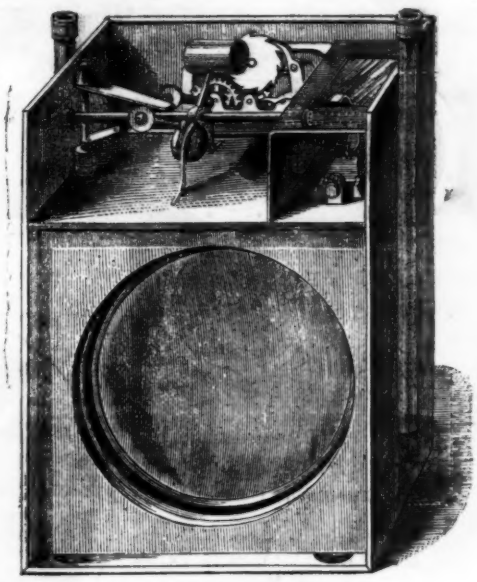
DRY

GAS-METER

SINGLE DIAPHRAGM.

TELLING & JOHNSON'S

PATENT.



Back View.

I. **The mechanical construction of this Meter is simpler and stronger than any other.**
II. **About half as much leather is used as in ordinary dry Meters.**
III. **The Meter has only one valve, and this cannot "stick."**
IV. **The lights maintain perfect steadiness and strength of flame. There is no "draw."**
V. **The gas consumed can only be measured from the inlet to the outlet, and**
VI. **The index cannot be made to register backwards.**

THE IMPERIAL METER COMPANY, LIMITED, ALSO MANUFACTURE ORDINARY DOUBLE DIAPHRAGM DRY GAS-METERS OF ALL SIZES, BOTH IN TIN AND IN CAST-IRON CASES.

SPECIAL ATTENTION

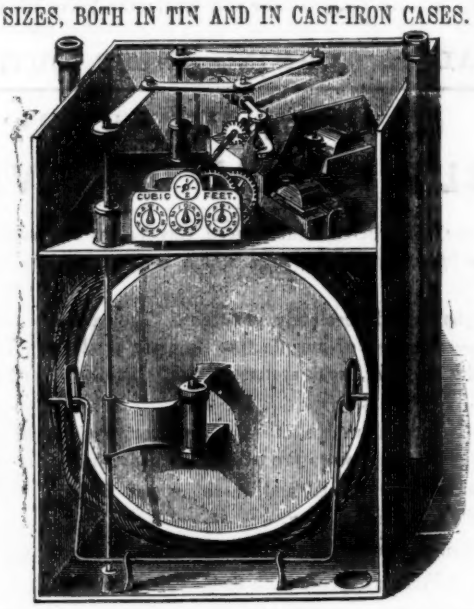
IS PAID TO THE

MANUFACTURE OF

STREET-LAMPS

AND

REGULATORS.



EVERY

DRY GAS-METER

IS UPHELD FOR

SIX YEARS

WITHOUT CHARGE.

THE IMPERIAL DRY GAS-METER.
Double Diaphragm.

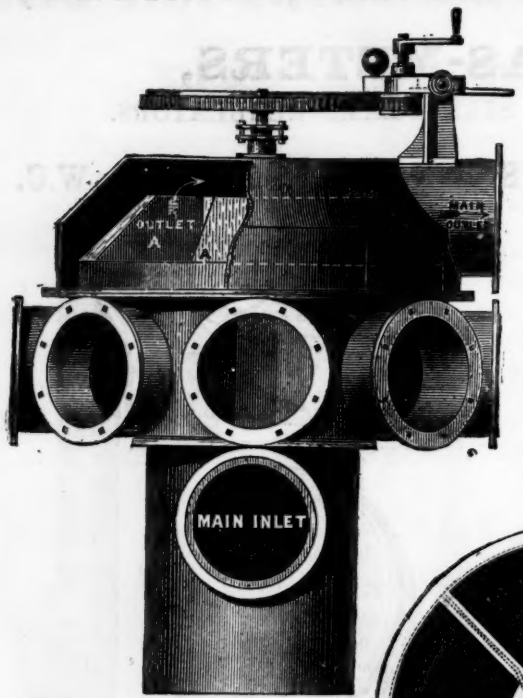
Mr. GEORGE MACKANESS will represent this Company in the Provinces.

OFFICES: 41, FLEET STREET, LONDON, E.C.

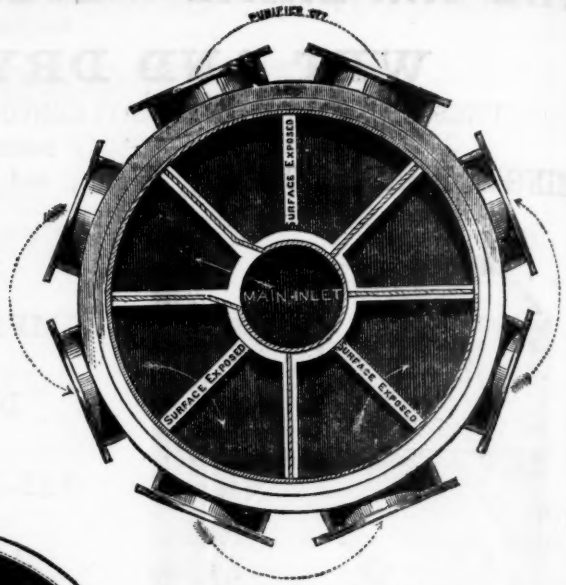
W. MOORE, Secretary.

☞ *All Communications to be addressed to the Secretary.*

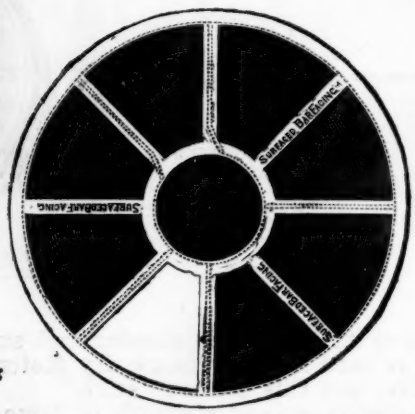
C. & W. WALKERS' PATENT CENTRE-VALVES.



Elevation of the Centre-Valve for four Purifiers. The safety cover is shown broken, to enable the Valve itself, which is inside, to be seen.



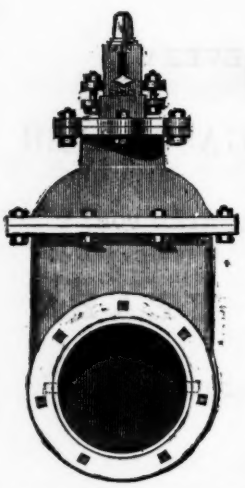
Plan of the Body, showing the Valve lying in it, with three of the facings, which were formerly exposed to settlements of dirt, carbon, naphthaline, &c., but which are now always covered by the surfaced bar-facings of the Valve. (See below.)



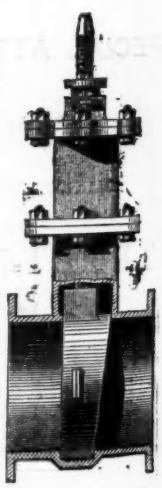
Plan of the Valve, or upper portion, showing the surfaced bar-facings referred to above.

These PATENT CENTRE-VALVES are the most perfect and certain means for working Purifiers. The Valve itself is protected from all injury inside the safety cover. The working of the Valve is so easy, and so governed by the stop-catch movement, that the Purifiers can be instantaneously changed in the dark as well as in daylight. They are scraped perfectly true, metal to metal, the facings heretofore exposed are always covered, and there is nothing more reliable, certain, and durable in a gas-works. By their use the floor of the Purifying-house is clear and level; the Valve and all connexions being beneath the floor, out of the way of working. A very considerable improvement and saving is effected in the cost of the connecting-pipes.

FOUR-WAY CENTRE-VALVES FORMING INLET, OUTLET, AND BYE-PASS.



C. & W. WALKERS'
DOUBLE-FACED GAS-VALVES.



These solidly constructed double-faced Gas-Valves are superseding the old system of the light, single-faced disc, which is too uncertain and unreliable in large bores.

They are guaranteed absolutely gas-tight. They are very massive and rigid, and by improved modes of manufacture they are produced at very little excess in cost over the old light, weak system, which is liable to spring and bend, and become leaky.

The Valve is a rigid wedge of solid cast iron, having two perfectly scraped surfaced facings fitting between the two on the body, which are also surfaced.

A spring in two short halves, and, therefore, not liable to break, is used only for scraping the front facing clean.

The front facing is vertical; the back facing forms the wedge.

At a slight additional expense both flanges are faced to bolt to main-pipes.

GASHOLDERS, TELESCOPE & SINGLE-LIFT, of LARGEST DIMENSIONS.

PURIFIERS, SCRUBBERS, CONDENSERS of most Improved Description.

WOOD SIEVES FOR PURIFIERS,

Which have now been in use for more than ten years, and their advantages and durability fully established. They are made entirely by steam machinery in very large quantities at the most moderate cost.

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SCARCITY OF COALS!!!

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GAS COKES TAKEN IN ANY QUANTITY IN RETURN WAGGONS, OR WAGGONS SPECIALLY SENT.

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PHŒNIX FIRE-BRICK WHARF,

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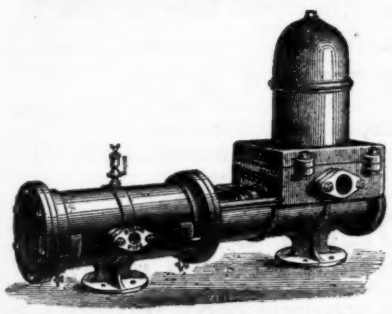
GAS ENGINEER AND CONTRACTOR FOR THE ERECTION OF GAS-WORKS,
AND FOR THE
SUPPLY OF RETORTS, FIRE-BRICKS, CAST-IRON MAINS,
AND ALL MATERIALS FOR GAS MANUFACTURE AND DISTRIBUTION.

THE PATENT

"UNIVERSAL" STEAM PUMP.



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HAYWARD, TYLER, & CO.,

84 & 85, UPPER WHITECROSS STREET, LONDON, E.C.

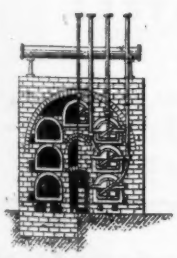
IN USE IN SOME OF
THE PRINCIPAL GAS-WORKS IN LONDON, SHEFFIELD, PENISTONE, &c.,
FOR
TAR AND AMMONIACAL LIQUORS.

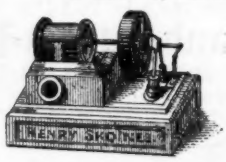
Ardwick Bridge Chemical Works, Manchester, Oct. 28, 1872.

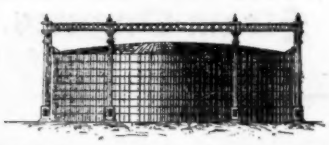
Sir,—The "Universal" Steam Pump obtained from you, and which has been employed during the last six months pumping caustic soda at these works, still continues working satisfactorily.—Yours truly,
(Signed) PETER HART, *Manager.*

HENRY SKOINES,

CONTRACTING GAS ENGINEER
FOR
SETTING RETORTS,
ERECTING AND REMODELLING GAS-WORKS
OF ANY EXTENT, AT HOME AND ABROAD.
RETORTS RESET, and the whole or any portion of Gas Apparatus supplied to the Trade, with their choice of name and device, if desired.







7, ARGYLE STREET, KING'S CROSS.

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MADE BY MACHINERY
CAPABLE OF MAKING 10,000 FEET WEEKLY.
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CLOTH GAS-BAGS FOR MAINS,

As supplied to the Imperial, Chartered, and other London and Provincial Gas Companies. Bellows and Valves for inflating Well Dresses, Stokers Gloves, India-Rubber Suction and Delivery Hose, Gas-Tubing, Leather, India-Rubber and Gutta-Percha Machine-Bands, Sheet and Washers for Steam Joints.

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for Streets and all Situations where the Light ascending above the level of the Lamp is wasted,
Is now in use in Moorgate St., London, and has been in successful operation upon Waterloo Bridge since Oct. 7, 1871.
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INVENTOR AND PATENTEE.

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SUPPLIED BY
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COAL and CANNEL
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Prices Quoted on application.

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CAST-IRON GAS AND WATER PIPES AND FURNISHINGS.
MALLEABLE IRON TUBE FOR GAS, WATER, AND STEAM.
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PATENT DRY GAS-METERS
DELIVERY F.O.B. ON CLYDE.
Lists on application.

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Successors to
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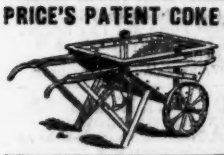
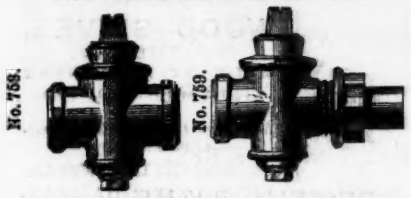
PRICE'S PATENT COKE & COAL BARROW,



effecting a great saving of time, labour, and expense.
For particulars, price, &c., apply to Mr. E. PRICE, Inventor and Patentee, Gas-Works, Hampton Wick, MIDDLESEX.

LAMBERT'S
CAST-IRON GAS-MAIN COCKS,
WITH PATENT WHITE METAL PLUGS.



The bodies of these Taps are made of Iron, black or galvanized, and the Plugs of Patent Metal. They are warranted not to set fast or corrode as do iron or brass Cocks, will always work easily, are strong, well made, durable, of little or no intrinsic value, and, therefore, not likely to be stolen; and the PRICES are (especially upon the larger sizes) FULLY 50 PER CENT. LESS THAN BRASS COCKS.

GAS-JOINTS, CHANDELIERS, PENDANTS, BRACKETS, ETC.; WROUGHT-IRON WELDED TUBE AND FITTINGS, BRASS, COPPER, LEAD, TIN, AND COMPOSITION TUBING,
Stocks, Taps, and Dies, and Every Description of Gas-Fitters' Tools; Gas Slide and Sluice Valves;
CARTER'S SAFETY GAS-VALVES;
GAS-STOVES, REGULATORS, BURNERS, &c.
Pattern-Book and Price List of Gas-Fittings, supplied on application.
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DEPÔT for STOURBRIDGE AND NEWCASTLE FIRE-BRICKS, LUMPS, TILES, and FIRE-CLAY, and every Article suitable for
GAS AND WATER WORKS.

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ARDWICK IRON-WORKS,
FAIRFIELD STREET, MANCHESTER,
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PIPES, VALVES, IRON ROOFS,
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SUPPLY GAS & WATER PIPES of EVERY SIZE.
Plain, Turned and Bored, and Coated.
CAST-IRON RETORTS.
Castings for Gas-Works of every description.
EXHAUSTERS.
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BLAYDON-ON-TYNE.

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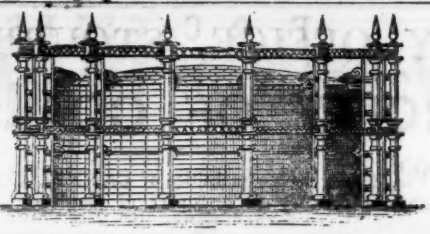
GAS ENGINEERS,
MANUFACTURERS AND CONTRACTORS FOR GAS-WORK
Of any extent at Home and Abroad,
GOWTS BRIDGE WORKS, LINCOLN,
AND
1, WESTMINSTER CHAMBERS, VICTORIA STREET, S.W.

HOPE IRON WORKS,

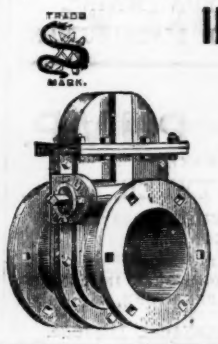


STOCKTON ON TEES.

ASHMORE & WHILE,
GAS ENGINEERS & CONTRACTORS,
MANUFACTURERS OF GASHOLDERS,
GAS APPARATUS OF EVERY DESCRIPTION,
Including Improved
Retort-Lids, Boilers, Cast and Wrought Iron Tanks, Iron Roofing, Bridges, Girders,
And GENERAL IRONWORK.

N.B.—Estimates for all Gas Plant and Remodelling supplied on application.

B. DONKIN & CO.'S
IMPROVED GAS-VALVES



WITH WROUGHT-IRON PINIONS,
List of prices, with full dimensions of all sizes up to 48-inch, to be had on application.
These Valves are all proved on both sides to 30 lbs. on the square inch before leaving the works, and are always kept in stock.
VALVES MADE WITH OUTSIDE RACKS TO ORDER.
ALSO,
SCREW WATER-VALVES WITH GUN-METAL FACES.

B. DONKIN & CO.,
GENERAL ENGINEERS AND IRONFOUNDERS,
MAKERS OF STEAM-ENGINES,
BLUE ANCHOR ROAD, BERMONDSEY,
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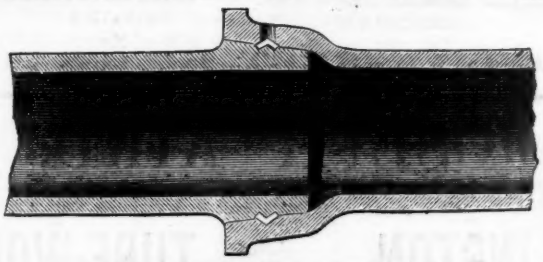
ELLAND, near HALIFAX,
MANUFACTURES AND ERECTS
GAS APPARATUS & MACHINERY
OF EVERY DESCRIPTION.
GAS EXHAUSTERS,
WITH STEAM-ENGINES COMBINED.
DRY, CENTRE, AND BYE-PASS VALVES; WROUGHT-IRON AND CAST-IRON SCRUBBERS; ANNULAR AND PIPE CONDENSERS, ALL SIZES.
PURIFIERS from 4 to 40 FEET SQUARE,
Steam-Engines, and Steam-Pumps.
RETORT SETTERS & FITTERS SENT TO ALL PARTS.
ALL WORK AND MATERIALS GUARANTEED OF THE BEST DESCRIPTION.



SOMERVILLE'S
PATENT JOINTS FOR GAS & WATER PIPES

Require no "yarning," no "setting up," nor increased excavation for joint-holes, while less lead and less labour suffice for the making of joints, which have been proved to withstand 95 lbs. on the square inch, have stood the test of more than two years practical use, and must, from the principle of their construction, remain sound.
For Licences to Manufacture, apply to
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42 PARLIAMENT STREET, WESTMINSTER, S.W.

F. & C. OSLER,

45, OXFORD STREET, LONDON, W.

MANUFACTORY AND SHOW-ROOMS:

BROAD STREET, BIRMINGHAM.

ESTABLISHED 1807.

MANUFACTURERS OF CRYSTAL GLASS CHANDELIERS,

WALL LIGHTS, AND LUSTRES FOR GAS AND CANDLES.

TABLE GLASS OF ALL KINDS.

CHANDELIERS IN BRONZE AND ORMOLU. MODERATOR LAMPS.

GEORGE ORME & CO.,

GAS-METER MANUFACTURERS, BRASSFOUNDERS & FINISHERS,

ATLAS METER-WORKS, OLDHAM.

CONSUMERS WET & DRY GAS-METERS ON THE MOST APPROVED PRINCIPLES.

STATION-METERS, GOVERNORS, PRESSURE-REGISTERS,

And every Description of Gas Apparatus.

GAS, STEAM, AND WATER FITTINGS.

GEORGE ANDERSON,

GAS AND CONSULTING ENGINEER,

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MR. ANDERSON advises Companies on all matters connected with the manufacture of Gas and the construction of Works.

PATENTEE and MANUFACTURER of the following Inventions:—

RETORT SETTINGS, heated by tar without the production of smoke.
STEAM-ENGINES and EXHAUSTERS, separately or combined.
FOUR-WAY VALVES, one of which is equal to three ordinary Valves.
STATION GOVERNORS—the Gasholder cannot tilt and cause accident.

BREEZE AND TAR FUEL MACHINE.

A Pamphlet containing Eighteen Illustrations of the foregoing, with letterpress on the construction of Works, post free, 2s. 6d.

N.B.—The second edition of this Work, *now ready*, contains illustrations of the Machine for converting Breeze and Tar into Fuel for heating the Retorts.

"The Author is well qualified to speak authoritatively upon the important subjects to which his pamphlet refers."—*Artizan.*

TRADE MARK. J. BEALE'S PATENT GAS EXHAUSTER.

BEALE'S CONTINUOUSLY ACTING

GAS EXHAUSTERS

ARE NOW MANUFACTURED BY

B. DONKIN & CO.

MR. J. BEALE, of East Greenwich, having retired from business, has made an arrangement with B. DONKIN & CO. for the sole manufacture of his Patent Solid-Slide Gas Exhausters.

B. D. & Co. also make Steam-Engines to drive Gas Exhausters direct or otherwise.

Estimates and Prices on application to

B. DONKIN & CO.,

ENGINEERS & IRONFOUNDERS,

BERMONDSEY, LONDON, S.E.

TO GAS COMPANIES AND THE TRADE.

J. DEFRIES & SONS,

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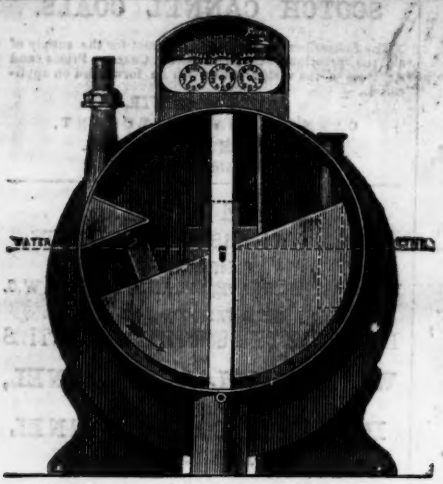

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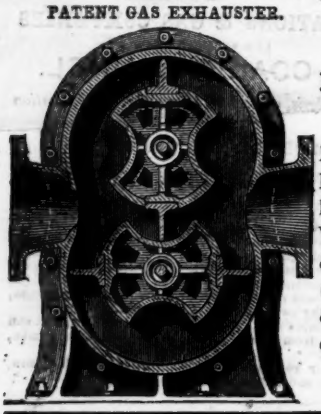

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